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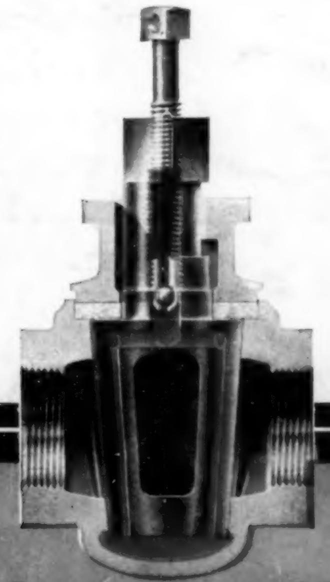
CHEMICAL & METALLURGICAL ENGINEERING



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Volume 34 *Number 6*

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. PARMELEE
Editor

Volume 34 — New York, June, 1927 — Number 6

Industry Absorbs the Technical Graduate

JUNE marks the annual harvest of college graduates and emphasizes the American demand for education. As a people we believe in a period of preparation for earning a living. Compared with our increase in population, high school attendance has mounted many fold in ten years and the colleges have been pressed beyond capacity. One result has been a searching analysis of the aims and purposes of formal schooling and the extent to which it fits the student for useful work. Another is a breaking away from traditional methods of education in an effort to meet the needs of a diversity of students.

IT IS a common criticism of American education that it is utilitarian, that it neglects cultural and intellectual pursuits, that it develops a body of machine-tenders. A truer interpretation suggests that we are merely diversifying our types and methods of education to conform to our industrial philosophy. Having developed an industrial civilization unlike that of any other nation, we perceive the necessity of paralleling that development with training to meet new demands. The liberal arts are still generously patronized, professional scientific and engineering education is on a high plane, but these are being supplemented by intermediate forms that widen opportunity and fill important gaps.

PROBABLY the outstanding characteristic of American technical training, as contrasted with education in liberal arts, is its sense of direction. It has a specific aim, its product is qualified in some particular. This contrast was unconsciously emphasized by a cover cartoon on the "Commencement" number of *Life* depicting in exaggerated form two modern college graduates of both sexes voicing their common dilemma—"Well, what shall we commence?" One gathers that their education had fitted them well for traditional college life, but had suddenly left them puzzled over their relation to the world of affairs.

IN GENERAL the technical graduate finds himself in no such predicament. He has been given a sense of direction. His training has borne a relationship to the world toward which he has been traveling. And industry absorbs him to their mutual advantage, whether he be versed primarily in the fundamentals of science and engineering or in the details of their application within a single plant. His translation to productive work is effected speedily and he becomes oriented in his new environment with little difficulty. The process has a fair degree of continuity.

IN AN effort to shorten the period of adaptation some schools have intensified their industrial relationships. The co-operative plan, as at the University of Cincinnati, early injects the student into the environment in which he is finally left on graduation. By a different plan the Westinghouse Technical Night School enables ambitious workers to continue their daily work and pursue technical study at night, thus eliminating the problem of adaptation to industry. Such developments may excite the critics, but coupled with conventional methods of technical training and the work of trade schools they offer diversity of opportunity and product that meets American needs. Each has its reason for existence, and each its own degree of culture. The advantage of all lies in their close correlation of activities before and after graduation.

Increased Output Per Worker

A RECENT STUDY of census figures by the Department of Commerce shows an increase in output per worker in the United States of nearly 50 per cent in the period from 1899 to 1925. This is a remarkable figure, but more remarkable is the increase of 40 per cent in output per worker between 1919 and 1925, and of 10 per cent in the two years from 1923 to 1925.

While some of this increase is attributable to increased personal efficiency on the part of the individual worker, by far the larger part must be credited to such factors as the increasing utilization of machinery and power, the introduction of labor saving devices and methods, the growth of mass production of standardized products, the avoidance of unnecessary wastage, the planning of production to meet sales possibilities, and, perhaps more potent than anything else, the shifting of endeavor to lines of industry where the foregoing factors can be made most effective.

Now all these various factors that have served to increase production, except in part that of increased personal efficiency, are the concern of management. When one looks back a few years to Secretary Hoover's report on the elimination of waste in industry, one recalls that the greater part of such waste was held to be the responsibility of management and great stress was laid on the necessity for management to avoid such waste in the future. While the present study gives no basis upon which to determine exactly the progress that management has made toward this end, the figures of increased output per worker show that at least part of this progress has already been accomplished. It is evident that the time is approaching when no general indictment of industrial management can be made on the score that it is not doing its work well.

Promise of Research In Iron and Steel

CONSIDERING its size and importance in comparison with other major industries the iron and steel industry has been a laggard in organized research. Consequently it is a pleasure for *Chem. & Met.* to note the recent announcement by Judge Gary that the United States Steel Corporation is to establish a Department of Research and Technology. This marks a lively step forward in the history of an organization that has commanded the admiration of the world for its sound business management, its stabilizing influence on production and distribution and its general efficiency as a great economic unit in American industry.

If formal recognition of the importance of research seems to have come late in the corporation's business program, it is none the less welcome to the industries consuming iron and steel products in chemical engineering equipment. Judge Gary's explanation of the apparent tardiness is that large bodies move slowly; but once started he hopes to have "a very thorough and efficient organization, one of the best." Research has not been wholly lacking in some of the corporation's units and some excellent work has been done, but the present undertaking should give a new impetus to this work and correlate individual effort.

Demand for research in ferrous engineering materials has been intensified by the development of new processes in the field of chemical engineering. These processes, scientifically developed, have often been halted in their application by the lack of suitable materials of construction. In an era of special technical problems, the lack of metallurgical research by the producer has been a handicap to the consumer who has often been obliged to work unaided. A lively demand now exists for special metals and alloys for highly specialized uses, and unless such materials are made available industrial progress must be slow.

Success in a research program rests primarily on personnel—the director, his associates and advisers. To this end the Steel Corporation has taken adequate steps through the selection of Dr. John Johnston as director of the new department and the appointment of Dr. R. A. Millikan to the executive council. Dr. Johnston is well known as professor of chemistry in Yale University, and Dr. Millikan has achieved an enviable reputation as a physicist at the California Institute of Technology. Both are highly qualified in their respective branches of science and will give a definite sense of direction to the research program. Under this leadership backed by the Finance Committee of the corporation the iron and steel industry may be expected to achieve great things for itself and those who use its products.

When Chemical Industry Starts Fertilizer Manufacture

THERE is abundant evidence that the gap between fertilizer and heavy chemical industries is likely to be bridged as the result of recent chemical engineering developments. It will be recalled that the fixation of atmospheric nitrogen served as the foundation on which the German chemical industry developed the production, first of synthetic ammonium sulphate, then nitrogen-phosphorus compounds, and finally the complete concentrated fertilizer materials containing the nitrogen, phosphorus and potash essentials. Progress in the United States has been somewhat slower, but as our air-nitrogen industry completes its capture of the anhydrous ammonia market, the production of synthetic fertilizer begins to loom on the horizon. Forecasting such a program has been a series of interesting developments.

First there was the announcement of the purchase of a site at Hopewell, Va., on which it is reported that a large air nitrogen plant is to be built by a subsidiary of the Allied Chemical & Dye Corporation. From the extent of the operations proposed, it is apparent that the fertilizer industry is the only outlet that can offer a commensurate market for the product. Next came the rumor that the technical commission of the I. G., which recently returned to Germany, had under consideration a branch manufacturing plant in the United States. That the production of concentrated fertilizer was at least one of the objectives was indicated by the commission's interest in coal, lignite, limestone and phosphate deposits. The nine million cubic feet per day of byproduct hydrogen available at one of the carbon-black plants at Monroe, La., was said to be an additional attraction, and this, too, points to nitrogen fixation.

Most recent is the announcement of two significant acquisitions by the du Pont company. The purchase of the American patent rights for the Casale process now gives the American company control of two important processes for the production of synthetic am-

monia. Additional significance attaches to the further announcement that the du Pont company has acquired the rights to the Liljenroth patents in North America, China and Japan for the production of phosphoric acid and phosphorus derivatives. It is the combination of this process with the Haber-Bosch process that the Badische has been using at its Leuna works according to most recent reports.

Thus it would seem that preparations are being made for technical developments that are likely to have an important bearing on the future of the fertilizer industry. The production of new concentrated materials by chemical processes is only the first step in the program. It remains to have these materials used by the farmer and to set up new sales machinery, or to take advantage of existing means of distribution. The process promises to be one of broad national significance, but its progress will be watched with much interest by those who have an appreciation of the technical and economic difficulties that must be overcome in establishing new chemical engineering industries in this country.

"What Price Southern Progress"?

WRITING under such a caption in the May number of *The Ceramic Age*, A. F. Greaves-Walker, of the North Carolina State College, makes a strong plea that facts and figures be substituted for the generalities and exaggerations that have sometimes characterized the promotion of our great Southern resources. Conventions of the technical societies held in the South, public addresses and articles in the popular and technical press have broadly called our attention to industrial opportunities awaiting development in Southern States. But it must be admitted that there has been a noticeable inability to make available the definite sort of information on which the manufacturer can figure a dollar-and-cents return on an investment.

Although some of the South's advertising of its resources has doubtless attracted capital toward their development, it is also true that much of this promotion work has fallen short of its mark because of the lack of convincing data. "In a few states," Professor Greaves-Walker writes, "agencies have been established for the primary purpose of advertising the industrial opportunities and natural resources. Invariably these agencies have been manned by advertising specialists unsupported by engineers and economists. The result, as would be expected, has been that exaggerated claims and statements have been made that have frightened off rather than attracted possible investors."

Fortunately, in the more progressive centers of the South this situation is fast being remedied, and we find local engineers working closely with the state and city officials, the industrial departments of the railroads and other promotional agencies. It was for the purpose of encouraging this engineering co-operation in the appraisal of our chemical resources that *Chem. & Met.* began its series of regional studies last January. In each of the geographical districts prominent engineers have been asked to make available the definite information that the industrialist and his technical men would require in sizing up a location for establishing new industries.

Elsewhere in this issue the reader will find two articles of this series—one, a critical analysis of the industrial situation in New England by Gustav J. Esselen, Jr., and the other a survey by Andrew M. Fairlie of the chemical possibilities of the great southern state of Georgia. Both are worth-while contributions and, published simultaneously, offer interesting contrasts of the peculiar characteristics and advantages of each locality. There are many opportunities for chemical engineering development in both sections.

The Georgia article is the first of the series to appear on a southern state, and it will be followed shortly by similar discussions of the Carolinas, Alabama, Mississippi and Louisiana. It is sincerely believed that these will bring to *Chem. & Met.'s* readers an entirely new conception of the many chemical opportunities of the South, and in a measure will contribute to the work of those agencies in the South that are directing development in accordance with sound economic and engineering principles.

A Matter of Adjectives

IF PHYSICAL SCIENCE is to take its place in the humanities it is time to consider the adjectives we use to describe and define it, for tradition holds that ripe and abundant scholarship is of the humanities, of which an important feature is gracious speech. And gracious speech is always severely mindful of its adjectives.

So when we speak of pure and applied science, more particularly of pure and applied chemistry, we are using adjectives that do not pair well in their meaning. We call research on atomic structure or the periodic law or octets or enzymes and in innumerable other directions, pure chemistry. The same chemical procedure in an industrial laboratory or works we call applied chemistry. Thus while adding to the world's store of knowledge is a "pure" act, the use of information from the same store of knowledge for any purpose is, properly speaking, an act in applied chemistry. But in adding to the world's store of knowledge with no thought of ulterior purpose other than extending it, we constantly make use of discovery which is already of record. In doing so we apply that which is known in the search of the unknown, and the "purity" of the act of applying this knowledge is brought into question on the ground that we have made applied chemistry the antonym of that which we call pure.

If we apply the work of one original authority in research to establish the existence of a new element, or apply the work of another to discover a new dye or to develop a new alloy, we are in both cases applying chemistry of record. And it is not impure or corrupt chemistry in which the man of research in industry engages. If his chemistry were impure he would be less likely to achieve results. Pure is therefore the wrong adjective because all sound chemistry is pure. Chemical reactions are chemical reactions, whether they take place in a beaker or in a tank. Substances may be pure or impure, but chemistry, in our opinion, is always pure.

Therefore we suggest another adjective to take the place of the erroneous one that we have cherished all these years. We suggest that what we have called "pure" be termed "fundamental" chemistry. Then we can apply fundamental chemistry whenever and wherever we please; the oftener the better.

Renew Your Acquaintance With Chemistry This Summer

"BEGINNING where your college days left off" is a slogan borrowed from the alumni magazine of one of the Mid-Western universities, but it might just as appropriately have been applied to the unique chemical education-vacation experiment to be tried out next month at Penn State. The Institute of Chemistry of the American Chemical Society promises to serve a very commendable purpose in bringing together a congenial group of chemists, engineers and industrialists who will renew acquaintance with science—particularly with the important scientific developments that have been progressing so rapidly in recent years. "College days left off" for many of us at a time when electrons, isotopes, quantum theories and cosmic rays were yet to find their way into chemical text books. Since then most of us have had to specialize and have been forced into fairly narrow grooves that haven't permitted many side trips into the interesting realms of chemical and allied sciences.

The Institute affords an opportunity to spend three or four weeks among most pleasant surroundings with a program of instructive lectures, discussions and conferences with scientists who have been responsible for much of recent progress and scientific advance. And for those industrialists and others interested in chemistry but not exactly members of the profession, there are to be popular lectures on science that will sweep away the cobwebs and give one at least a speaking acquaintance with the many-sided science.

The Institute of Chemistry has an opportunity to accomplish much good for the cause of chemistry. Likewise, the chemical and chemical engineering professions have in the Institute an unusual opportunity to help chemistry by helping themselves. In commending the work of the Institute, *Chem. & Met.* heartily recommends it to those of its readers who are looking for a pleasant and profitable vacation.

What About Declining Prices?

FOR THE PAST two years manufacturers have faced a trying problem in the consistent downward trend of commodity prices. The problem has been most acute with those chemical plants that produce raw materials for other industries. Thus the manufacturer of the finished product, when facing the problem of reducing his costs, can turn to the chemical manufacturer and demand lower priced raw materials, but the chemical manufacturer can find little relief in this direction for his raw materials are usually primary ores and natural products the cost of which is fixed by mining, labor and transportation charges. A few chemical manufacturers have been gradually narrowing the margin between costs and selling prices in the vain hope that somehow the situation would remedy itself. Others have taken the more logical view that they must work out their own salvation and have set about to reduce their costs or to find more lucrative consuming markets for their products.

Within the past fortnight this problem of declining prices has been the subject of serious discussion at meetings of two important trade associations within the chemical field. It is of interest to observe and contrast the views reported. The retiring president of the National Lime Association in addressing the recent convention at White Sulphur Springs, had this advice for the lime industry: "There is a general downward trend in all commodity prices, but the rate at which this trend progresses and its possible interruption for shorter or longer periods is largely dependent upon the relation between consumption and production capacity in each industry. As an industry we have an entirely legal method of staying this trend by energetic sales promotion of new uses and enlargement of old uses of our product. We have full legal and moral right to exercise collective effort in this character of promotion work, and unless it is done with great force we can expect a downward trend in commodity prices to continue to affect lime prices. This downward trend has amounted to over 10 per cent in the past fifteen months, and while the situation has varied in many lime districts, and in the various grades of lime, I should imagine that the average price trend in lime products during the same fifteen months has not been far from the average general drop of 10 per cent. I should only ask you whether you will decide to see this trend continue or whether it is your intention by sales promotion campaigns to legally combat this downward trend."

The chairman of the executive committee of the Manufacturing Chemists Association in the annual report of that organization, reflects a somewhat different attitude and in turn suggests the possibility of a different remedy. "To this task of industry in general," says the report in referring to the problem of reducing production costs, "the manufacturing chemist has been summoned to render assistance of the first order. Economies in operation are a stern necessity and they call for the last extractable value out of the material developed in every stage of manufacture up to the finished product. Thus it comes about that dependence is placed upon the chemical laboratory to search out values in the waste or to develop processes that will give it utility. Again, demand is made for new products of chemistry that will cut labor costs by simplifying processes or that will achieve similar results by improving quality of output. In the double duty of ordering our own business to meet the economic demands of the time, while bringing aid to other industries toward the solution of their cost reduction problems, your executive committee feels that there has been a fair degree of accomplishment. If evidence were needed that the chemical industry is responsive to its part in contributing to the maintenance of national prosperity by reduction of costs, we point to the report of the U. S. Bureau of Labor Statistics which records that the index number of chemicals, based on 1913 at 100, was in April, 1927, 116.3, while the average for all commodities was 142.4. Other Government reports likewise testify to creditable performance."

The futility of permanently opposing this general economic trend to lower prices is becoming more and more apparent. The industry that will profit most is the one that will see in this trend an obligation to set its house in order, to eliminate the obsolete and to improve its production processes by the increasing use of machinery and power. Chemical industry has an enlarged opportunity for additional economies in the application of chemical engineering methods in research, production and sales.

Chemical Engineers Visit Cleveland

THE summer meeting of the American Institute of Chemical Engineers reported elsewhere in this issue, was an unusually successful convention. The attendance was nationwide and fully representative of the broad application of chemical engineering in industry. The program was marked by new contributions to fundamental knowledge as well as by useful industrial information. On the whole it was a meeting that one could ill afford to miss, considering its technical and social advantages.

Contributing to the success of the meeting was the perfectly functioning machinery of the local committees whose arrangements were well ordered and executed. The various events and functions moved forward on schedule time to the great satisfaction of officers, members and guests, with the result that four days were crowded with opportunity. Local industries in Cleveland, Rittman and Akron were unusually generous in opening their plants to inspection as well as contributing financially to defray convention expenses. For all these things the Institute is indebted to L. C. Drefahl, chairman, and B. A. Patch, secretary of the general committee and to Mrs. E. R. Grasselli and Mrs. W. A. Harshaw, chairman and vice-chairman of the ladies committee. With their co-workers they set a standard for future conventions.

The combined social, professional and business aspects of the Institute's conventions increase in importance from year to year. As a medium for the interchange of views and information on technical subjects they are unsurpassed. Through the opportunity they afford for personal acquaintance they result in legitimate business and professional advantages. By plant inspection the visitors learn of new products and methods and the manufacturers in turn are acquainted with new problems among their clients. The net advantage to all concerned is not to be underestimated. Going to conventions may be an American habit, but it is undoubtedly turned to advantage in many ways. And in so new and progressive a field as chemical engineering it is not difficult to get value received for the time and money spent in fraternizing with professional associates.

Apply the Surplus To Tax Reduction

OFFICIAL confirmation by Secretary Mellon and then by President Coolidge in his budget address on June 10 of the accumulation of a $600,000,000 surplus in the federal treasury renews attention to the demand on the part of industry for a reduction in taxes. Backed by the business interests represented in the 1,500 member organizations of the United States Chamber of Commerce, the taxation committee of the Chamber is suggesting a definite program of tax revision calling for a reduction of the corporation income tax to 10 per cent from the 13½ per cent rate now in force. Such a cut would amount to approximately $300,000,000 and would leave an equal proportion of the surplus for reducing war excises and other taxes on individuals, estates or particular businesses.

It is not always appreciated that corporate industry, which is the characteristic American method of doing business, carries the largest share of the federal tax burden. During the fiscal year 1926 corporations paid directly to the federal government more than one billion dollars or 34 per cent of the total taxes, including customs, which were collected by the national government. Add to this the $1,550,000,000 paid in taxes to state and local governments and there appears to be real justification for the taxation committee's view that our corporations are "the most universally taxed objects in the country."

An excessive rate of taxation on productive enterprise is unsound in principle and inequitable in practice. It is in effect a fine or penalty on the man or group of men who increase the manufacturing business of the country and therefore add to its wealth and purchasing power. Business has patiently borne this burden in the prospect that once the adjustments necessitated by the war and its aftermath had been made, the government might logically be expected to work out a more scientific and equitable division of taxes. The annual recurring surpluses may not offer a safe basis for a permanent revision and, as President Coolidge points out, "our revenue laws cannot be written from the standpoint of a single year." Nevertheless the next Congress that meets in Washington faces a definite responsibility to industry and a reduction of taxes on corporate business, even though temporary, should be speedily forthcoming.

Aviation and Chemical Engineering

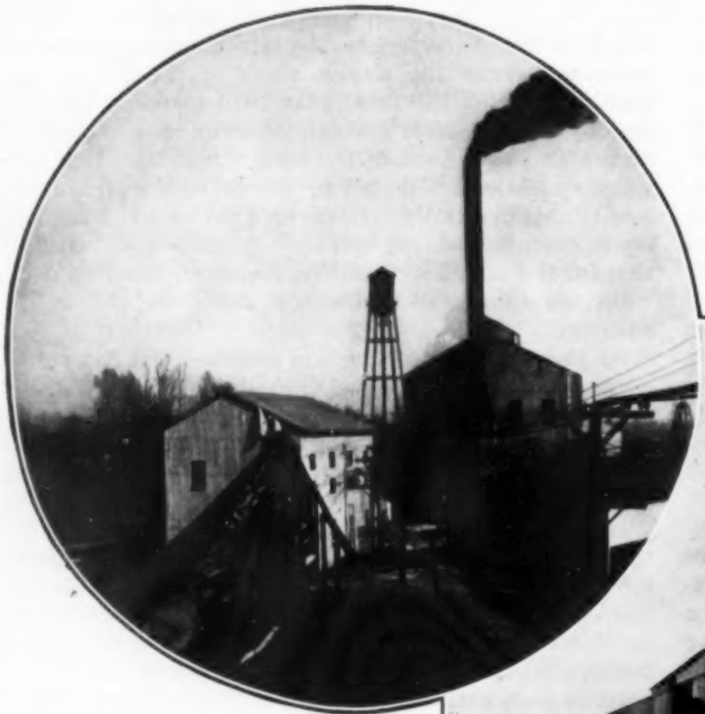
FEATS such as the recent non-stop transatlantic flights serve to crystallize attention on the increasing importance of aviation in the general scheme of things. While the daily press naturally emphasizes the dramatic and personal sides of such an event, the major significance really lies in other fields. The incidence of improved aviation on transportation, commerce, international politics and sociology must be noticed elsewhere; but for the industrialist there is much of promise in these achievements and for the readers of *Chem. & Met.* in particular there is stimulus to increased activity in research and development.

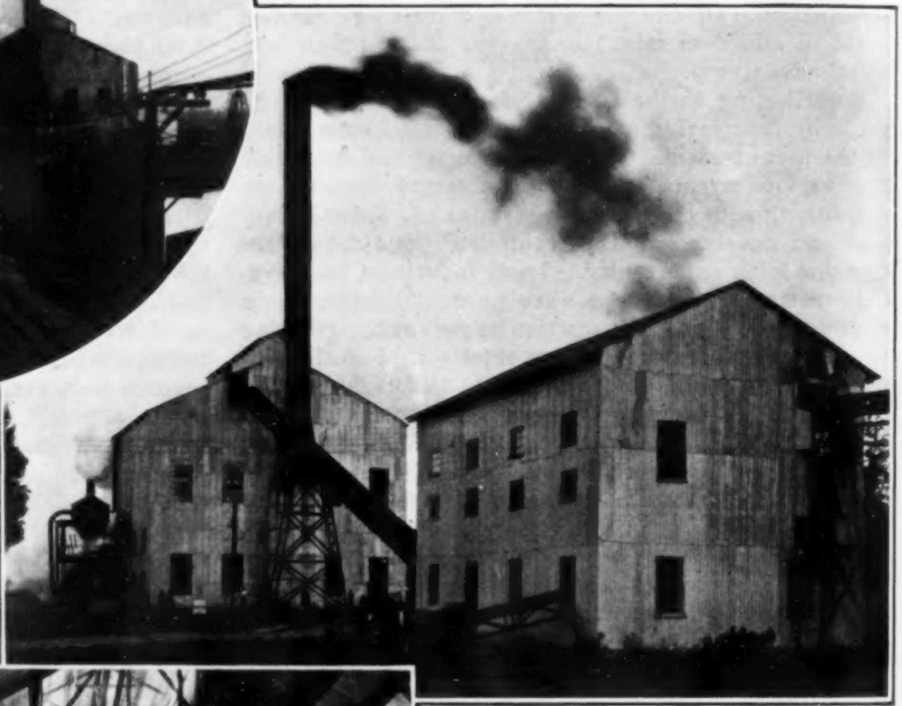
Nearly all the materials of a modern airplane, such as those used by Lindbergh and Chamberlin, are at least in part the products of chemical engineering industries. Special alloys, treated fabrics, treated woods, molded plastics and protective coatings go largely to make up the plane and its engine and accessories. Special fuels and lubricating oils are needed in the operation of these planes.

In the growth of aviation to its present state, chemical engineering has had a large part of which it can well be proud. But there must be no resting on the oars. If the isolated triumphs of a few master flyers are to become of everyday benefit to mankind, flying must be made safer and easier for the average flyer. This means, among other things, that better materials, fuels and lubricants must be developed. And in this development chemical engineers have perhaps the greatest single opportunity now before them for service to mankind.

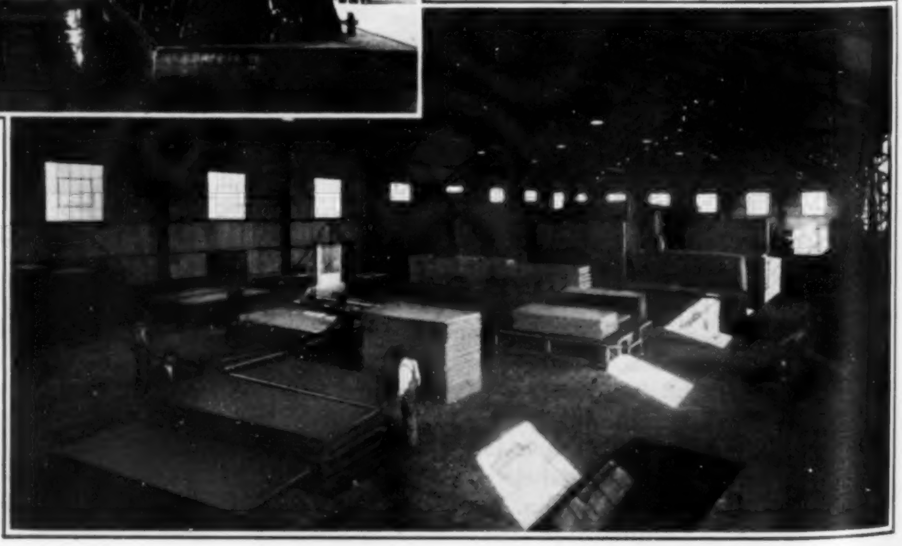
Where Sawmill Waste is made into Insulating Lumber

Slabs, edgings, board ends and sawdust are the waste materials from an adjacent lumber mill which are carried to the plant of the Mason Fibre Co. on the conveyor shown at the left. In the first building shown below the waste is hogged into chips which are carried to the manufacturing house and there exploded into fiber by means of steam at a pressure of more than 1,000 lb. per sq.in.





After the fiber has been shot from the high-pressure steam guns at a velocity of 4,000 ft. per second, it is refined and formed into sheets on the fourdrinier shown at the left. The huge hydraulic presses with their steam platens between which these sheets are pressed are also shown in this view.



This is a view of the finishing room, where the synthetic lumber is edged, cut to size and packed for shipment. Two products are made by slightly varying the manufacturing process. One is the Masonite structural insulation and the other is the hard board, presdwood, used in lining auto doors, for card table tops, etc.

Converting Sawmill Waste Into Profits

Sawmill Trash Burner Now Retired from Active Service

This huge burner, typical of many others in Southern sawmills, was formerly used for disposing of the slabs, edgings and other forms of lumber waste which the Mason steam-explosion process now converts into profitable synthetic products.

By Sidney D. Kirkpatrick
Associate Editor, *Chem. & Met.*

How the steam-explosion process developed by W. H. Mason makes synthetic insulating lumber and pressed wood board from waste materials which were formerly burned as trash

WILLIAM H. MASON, like E. G. Acheson and a few others whose names are associated with important achievements in chemical engineering industries, had the benefit of long tutelage under a great teacher—Thomas Alva Edison. In fact, something of the uncanny workings of the "wizard of Menlo Park" is often to be seen in the way his pupils have pushed beyond the borders of existing knowledge, to carry science and invention to new industrial accomplishments. After the close of the war when Mr. Mason had completed his work as general superintendent of construction in Uncle Sam's $12,000,000 shipyard at Bristol, Pa., he dedicated his talents to the lumber industry and in less than ten years has contributed at least two notable, if not revolutionary, advances. In 1922 his process for the extraction of rosin and turpentine from sawn boards, i.e., the simultaneous recovery of valuable products and the improvement in the market value of the lumber, won for Mr. Mason the honorable award of the National Lumber Manufacturers' Association. His most recent development—the Masonite fiber process—whereby the sawmill waste which is usually sent to the trash burner, is exploded from guns by high-pressure steam, was described to the Technical Association of the Pulp and Paper Industry at its February (1927) meeting and has since been referred to as "the outstanding development in fiber making of the past century." (See McNaughton, *Chem. & Met.*, April, 1927, page 258-9).

Having perfected his gum extraction process and put several plants into successful operation, Mr. Mason turned his attention to an even more important economic waste. The mill of the Wausau Southern Lumber Co. at Laurel, Miss., like most of the other Southern mills, was equipped with a great trash burner and into this a conveyor carried a continuous stream of slabs, bark-covered edgings, board ends and sawdust for which the lumber industry had found no other satisfactory means of disposal. When Mr. Mason tackled the problem of finding a commercial use for this waste, his first thought was to convert it into wood pulp for paper making. But these Southern pipe woods are so tough and gummy that mechanical grinding seemed out of the question. Likewise the bark and dirty, charred and decayed wood made chemical digestion difficult, if not commercially impossible. Then he recalled how wood, like other organic materials of cellular structure, became plastic under heat and moisture, due presumably to some change taking place in the lignins since the cellulose fibers remained practically unchanged. The idea occurred to Mr. Mason that the same steam used to soften the wood might, if its pressure were suddenly released, completely blow apart the fibers and give a material suitable for paper making.

He set about in the spring of 1924 to test out his idea experimentally, using for his first steam gun a piece of 3-in. steel shafting, hollowed out somewhat in the center and plugged with a valve that could be quickly knocked loose by means of a crow-bar and a heavy hammer. The gun was "loaded" with chips and water and heated from the outside with a couple of gasoline torches until the pressure had mounted to about 600 lb. per sq.in. Then it was suddenly opened. The result, as far as the defibering process is concerned, was a complete success although it took a long time, Mr. Mason reports, to find the original parts of the valve and to reassemble the improvised equipment.

But the soundness of the basic idea had thus been demonstrated and the remaining problems resolved themselves along three lines: (1) To establish by experiment the proper operating conditions, viz., the time required for adequately softening the wood, the optimum temperature at which the fiber would not be charred or otherwise deteriorated and the pressure sufficient to disrupt the fibers. (2) To find a practical and profitable use for the exploded fibers. (3) To de-

velop the large-scale equipment necessary for commercial production. The first task was comparatively easy and could be done in the crude experimental equipment with the few modifications that naturally suggested themselves.

The second objective proved more difficult since the preliminary tests made at the plant of the Bogalusa Paper Co. seemed to indicate that the fiber was not especially desirable for paper making. Shortly, however, the fact was appreciated that the steam-exploded fibers possessed desirable insulating characteristics, provided a suitable board or sheet could be made from them.

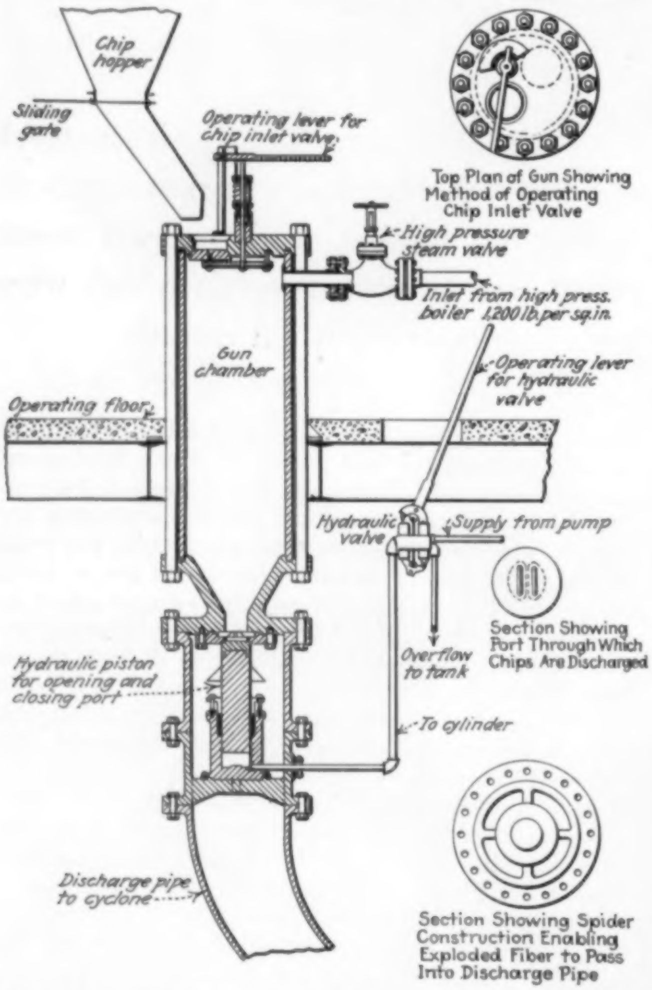


Fig. 1—Cross-section of the High-Pressure Steam Gun in Which Sawmill Waste is Exploded to Produce Raw Material for Insulating Lumber

Hydraulic pressing, even at pressures as high as 5,000 lb. per sq.in., failed to give at satisfactory board and the experiments were then transferred to the Rothschild, Wis., plant of the Marathon Paper Co. Using their beaters and a specially built fourdrinier, an insulating board of unusual properties was soon developed. Then, almost by accident, it was discovered that if this insulating board were left in a steam heated press under high pressure, it was transformed into a dense, stiff board of high tensile strength, unusually hard and tough. The trade name, Masonite, was given to the structural insulation and the hard board was appropriately called Masonite Presdwood.

With these promising outlets developed for the unique cellulose raw material and with the proper operating conditions having been determined by long experimentation, the remaining problem was the de-

Fig. 2—What the Explosion Process Accomplishes

The chips on the left are first exposed to steam at a pressure of 1,000 lb. per sq.in. and when this pressure is suddenly released, the individual fibres of the wood are torn apart to yield the moss-like mass shown in the right-hand view.

sign and construction of the equipment. Much of the final success of the process depended upon this factor and Mr. Mason (himself a mechanical engineer) and his associates spent several months in designing, testing and adjusting the various pieces of unusual apparatus necessary to carry out the manufacturing process. The gun itself and the unique hydraulic mechanism for its instantaneous discharge, proved to be the key equipment around which the process was to be developed. A cross section of this apparatus with detailed drawings showing the means of operating the charging and discharging valves, will be found in Fig. 1. The chips before and after their exposure to the exploding process are shown in Fig. 2. It will be noted that the defibered wood is a moss-like mass in which the individual fibers are completely separated or can be easily teased apart mechanically.

The high and low pressure steam required for the explosion process and for power purposes is generated

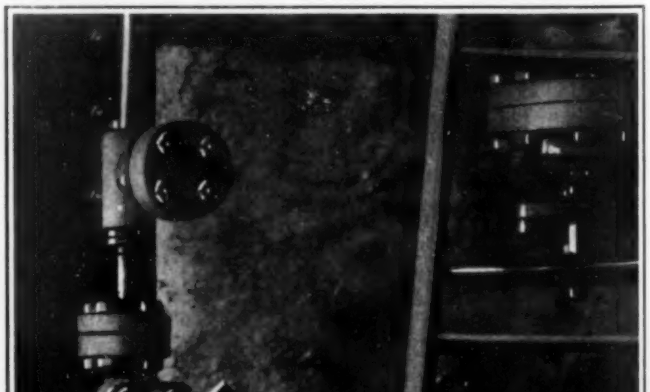


Fig. 3—Gage on the High-Pressure Boiler, Showing Normal Operating Pressure of Approximately 1,000 lb.

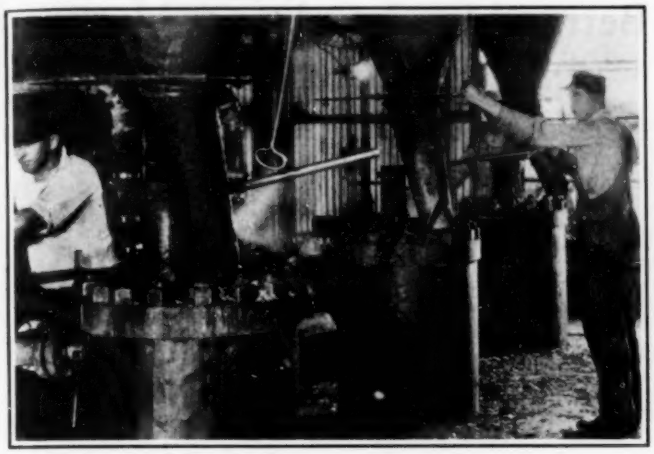


Fig. 4—Gun Platform Showing Three Steam Guns in Operation.
The operator at the left is opening the charging valve and his helper is loading another gun with chips from the hopper above.

in a 400-hp. Babcock & Wilcox boiler of unusually heavy construction. A solid steel drum forging 4 ft. in diameter with walls 4 in. thick is used for the drum. The boiler tubes are $\frac{3}{8}$ in. thick and 2 in. in diameter. The pressure gage shown in Fig. 3 is registering the normal working pressure of approximately 1,000 lb. per square inch.

The principal features of the other equipment used in the manufacturing process can perhaps best be described by following briefly the normal cycle of operation at the Mason Fibre Company plant in Laurel, Miss., which it was recently the privilege of the writer to inspect. The plant is located just north of the Wausau sawmill which is its only source of raw material. The character of this sawmill waste can be judged from the photograph on page 342, which shows it on the conveyor that brings it to the wood preparation house. Here it goes into the hog to be cut into chips which are screened and those of the size normally used in pulp making are carried on to the chip hoppers above the fiber guns. The balance of the hogged waste, comprising at present about two-thirds of the total, is routed to the power house and used as fuel under the boilers. Eventually this may also be available for processing.

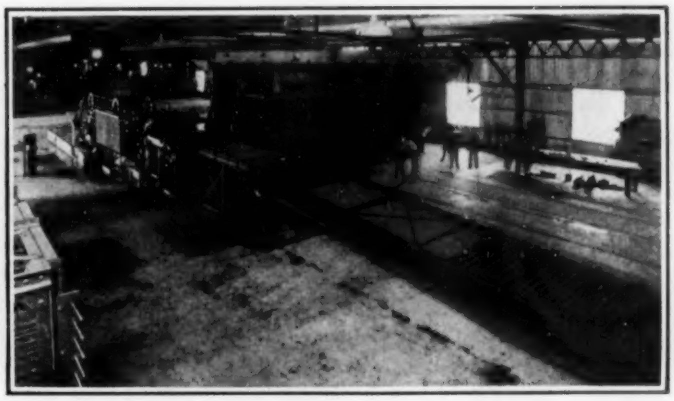
About 200 lb. of the green chips are charged into one of the three guns, the valve is closed, and for 10 to 15 seconds the chips are steamed at a pressure of about 200 lb. The lignins of the wood are thus softened and then steam at the full pressure of 1,000 lb. is turned on for an additional 3 to 5 seconds. Next the operator throws the lever that operates the hydraulic discharge valve and the chips are literally shot out of the gun, exploding into moss-like fibers as they shoot past the ports at an estimated velocity of 4,000 ft. per second. This is sufficient, of course, to carry the fiber and steam into the cyclone separator where the steam escapes to the atmosphere and the fibers drop back into the wooden stock chest. The cyclone, chest and steam separating from the fiber are clearly shown in Fig. 5.

After the fibers have cooled somewhat, water is added and the mass is forced through the refining machines and on to the fourdrinier. This machine, which is shown in Figs. 6 and 7, is 5 ft. wide and 36 ft. long, and has 3 pairs of press rolls. The fiber is first formed into a sheet about 2 in. thick, but on passing through the press rolls, this is reduced to about $\frac{3}{4}$ in. in thickness, An

Fig. 5—Cyclone in which the Steam Loses its Velocity and from which the Separated Fibres Drop to the Stock Chest Beneath

automatic cutting device cuts the sheets into 12-ft. lengths and these are ingeniously loaded on portable racks each of which holds 20 sheets or approximately 1,000 sq.ft.

These racks, which are on a narrow gage track, are then wheeled to the hydraulic presses and the wet sheets, supported on ordinary window screen wire, are drawn in between the steam heated platens and the press is closed. A pressure of about 2,000 tons can be exerted on each



Figs. 6 and 7—Views of the Machine Room Where Insulating Lumber and Hard Board Are Manufactured from the Exploded Fibers
At left are to be seen the hydraulic presses with the steam platens which are used in the finishing of the lumber and board. The fourdrinier is shown in the center of the right-hand picture. Note the rack on which the wet sheets are carried to the hydraulic presses.

press. There are four presses each with a capacity of 1,000 sq.ft. of material per charge. Except for cooling and trimming to size the insulation after about an hour's pressing is ready for packing and shipment.

The only change in the process in order to make pressedwood instead of the Masonite structural insulation, is in the pressing. For the former the platens are adjusted to give $\frac{1}{8}$-in. instead of $\frac{7}{16}$-in. thickness.

When manufacturing operations began at the Mason Fibre Co., in September, 1926, the plant had a production of about 2,000 sq.ft. per hour, which was about one-half of its rated capacity. For the month of January production reached 1,500,000 sq.ft. and except for a minor shutdown to repair the power turbine, the plant has since been in continuous operation and now producing over 2,500,000 sq.ft. per month. A considerable proportion of the output has been of the pressedwood which is largely used in lining automobile doors, as tops for card tables and desks, and in radio cabinets. It has a tensile strength of 4,000 to 5,000 lb. per sq.in., equivalent to that of many woods with the grain. But since the synthetic product has no grain its strength is equal in all directions and it is about ten times as strong as wood across the grain. As pressedwood leaves the press, one side is smooth and can be polished and finished to give a number of interesting effects. After being grained by a photographic process and then varnished or lacquered, it has all the appearances and wearing qualities of hardwood such as walnut or mahogany.

Fig. 8—Distant View of the Mill of the Wausau Southern Lumber Co. Which Supplies the Raw Material for the Mason Plant

Although the Mason Fibre Co. has confined its production to the structural insulation and hard board, a number of other materials have been produced experimentally. Bricks have been pressed from the fiber which might be used for exceptional requirements where strength and appearance as well as insulating properties are desirable. Heavy lumber made with pressedwood surfaces and Masonite cores offers a unique combination of qualities that might some day make it competitive with expensive lumber from other sources. And, too, there remains Mr. Mason's original objective in the manufacture of paper pulp. For the time being developments along this line have had to give away to the more promising commercial materials, but it is certain that the steam-explosion process has definitely pointed the way to a new source of wood pulp for the paper maker. As such it is a technical achievement that may be expected to exert a profound economic influence on an industry that has already become international in its search for an adequate supply of raw material.

Better Merchandising Methods for Fertilizer Industry

National Fertilizer Association studies the problem of making markets overtake manufacturing capacity

Editorial Staff Report

BIGGER markets reached by better merchandising methods with well-trained sales forces using only ethical trade practices were the objectives set by the fertilizer industry for itself in the Third Annual Convention at White Sulphur Springs, West Virginia, June 6 to 9. The general recognition of the importance of these efforts was clearly shown by the active interest of those attending, over 400 of whom made up the largest meeting of the National Fertilizer Association since the boom year, 1920, when the predecessor association attendance slightly exceeded this year's registration.

PRESIDENT Spencer L. Carter well described the major cause of the industry's trouble, pointing out that for the past two crop years agricultural production of the United States has decreased in value by $1,000,000,000 per year each season. Thus the farm buying power has been cut by more than 25 per cent since 1924. The result is that fertilizers in order to be sold at all have been priced at figures below pre-war values and in many parts of the country actually below cost of production. The present wholesale price index for mixed fertilizer is actually below the index for the raw materials used in its manufacture, as was shown later in the proceedings by C. J. Brand.

Important trends in the business indicated by Mr. Carter include: Further increases in use of concentrated fertilizers, more co-operative purchasing, adoption of fewer brands in accordance with the simplification programs of the various states, and large increase in cash sales. This last trend has apparently permanently changed and materially shortened the buying season.

The manufacturing side of the industry was almost wholly neglected by the convention, perhaps largely because it in recent years has progressed so much more rapidly than the marketing side. This, as explained by one speaker, introduces the interesting and dangerous problem of price-cutting, for "it is sometimes startling, after a manufacturing department has striven for a year or more to save 20 to 25 cents per ton in the cost of production, to see the latter more than neutralized in a few moments by a much larger concession to the buyer."

The convention was repeatedly reminded of the industry's obligations in selling under the Code of Trade Practices which it unanimously adopted some months ago at a special meeting; but it was pointed out that in actual fact "the Code has not yet been given even a suggestion of a trial." In this condition Secretary Brand emphasized that "until it (the Code) and other means which lie at our hand are used to the full, we cannot hope for any amelioration of statutory prohibitions which we may feel inhibit the reasonable and proper development of our industry.

In an effort at self diagnosis of the industry Mr. Brand considered six natural divisions of the business and gave his opinion of their condition, as follows:

1. Rock phosphate production—"Some problems exist in this field," but "on the whole it is operated efficiently and does not play a large part in the difficulties that beset the industry."

2. Acid phosphate manufacture is "on an efficient and reasonably satisfactory basis, but systematic knowledge of costs is none too widespread." "Present demand for the most part is within the range of 16 and 20 per cent available P_2O_5." "Savings of 25 cents or even 75 cents a ton, while they would help and should be made, will not get us out of our present morass."

3. Distribution and sale of acid phosphate is "our first genuine stumbling block," and fraught with practically the same danger for the dry mixer as for the acid phosphate manufacturer." "Selling at less than cost—starts the vicious and sapping disease—destructive to the whole industry."

4. Purchasing raw materials, bags, etc., is a legitimate field for competitive effort, with no disturbance to industry.

5. Production of mixed fertilizers involves simple technology, important but easy chemical control, and elaborate plants, but is not the source of infection to the industry except when unsound cost keeping or overproduction occurs.

6. Sale and distribution of mixed goods reveal a situation that "would be comic if it were not so tragic." In this field lie most of the industry's ten "*worst problems*," listed by Brand as:

"Overcapacity; overproduction; multiplicity of producers and distributors; unrestrained and uneconomic—if not unfair and hence illegal—competition; suicidal pricing system; unethical business conduct; ruinous credit policies; a vicious practice of deferred settlements; occasional loss of control of field forces in the selling end; and absence of genuinely good merchandising of the product, due partly to lack of stimulus for dealers."

Among the remedies prescribed are voluntary curtailment of production, improved personnel, real application of the Code of Trade Practices, numerous natural consolidations in the business, increased sales by advertising and scientific promotion of the business, and better and more used statistical service. Cuts in transportation costs, now 25 per cent of total delivered cost of fertilizers, are also needed, but should come without damaging effects on carriers wherever possible.

The industry went far outside its own borders to get prominent speakers who might aid it in the merchandizing problems confronting it. Among those who contributed thus were E. S. Lewis, sales and merchandising counsellor of the Art-Metal Construction Co., Charles C. Parlin, director of commercial research of the Curtis Publishing Co., and C. C. Concannon, chemical division chief of the Bureau of Foreign and Domestic Commerce, who spoke particularly of foreign market possibilities and the aids available to the industries through the Department offices.

Over 35 per cent of fertilizer sales in the South are for cotton in the Carolinas, Georgia, and Alabama; but this market is seriously threatened despite the fact that it is in the main the most dependable cash-producing crop of the Southeast and should remain so for years to come. The threat is from large acreage (23.5 million acres in 1926) and new mechanical "extensive" systems of cotton growing and picking in states west of the Mississippi, particularly Texas and Oklahoma. Changes demand more production per man and per mule as well as per acre, and much lower cost methods are essential. This situation was summarized by J. C. Pridmore who heads the southern division work for the Soil Improvement Committee.

MUSCLE SHOALS, still unsettled by the last Congress, occupied first place in the legislative problems reported by John F. Tierney who has served as in previous years as a joint agent of the Fertilizer and the Manufacturing Chemists' associations. This lack of settlement with other recent developments was cited as vindication of the ideas and arguments of the fertilizer industry as presented to Congress during past years.

Potash developments and explorations in the United States give promise of a desire to develop this new industry; and this in turn may lead to demands for import tariffs on potash to protect producers, which will be detrimental to and require action by the Fertilizer Association, Mr. Tierney reported. In the field of stream pollution by industry he also expects further problems due to increased activity by sportsmen and public officials. Other activities engaging the attention of this office included: Revision of I.C.C. tank car specifications for acid cars; a proposed survey of Latin American markets for fertilizers; conflicting customs decisions on the classification of tankage, which render it uncertain whether duties will be assessed on particular shipments; and co-operation with the National Fire Protection Association on methods of fighting fires in which nitrate of soda is involved and attendant questions of insurance rates on nitrate storage.

A paper by the eminent soil scientist, Sir John Russell, presented a review of eighty-five years of fertilizer experiments at the Rothamsted station, where the first work in the world of this sort was undertaken in 1842 by John Bennet Lawes in an effort to improve his turnip crops. It was a long and complicated course from that first work with acidulated ground bone to the present work, which is world wide in reputation.

DURING the past year the Association has started a new line of service to the industry through the employment of an experienced cost accountant to assist member companies in applying to their business the standard accounting practice which has been approved by the two codes of the Association. William B. McCloskey, who has had this work for the Association, reported on his experience in this study of company work and made a preliminary summary of the effort to secure certain standards of costs.

What cost accounting has done for other industries was also described to the convention by a paper of Thomas W. Howard of the Chamber of Commerce of the U. S. Numerous examples of savings were recounted from the experiences of other industries, especially those resulting from co-operation.

At the close of the meeting the board of directors announced that E. L. Robins of Meridian, Miss., had been elected president of the National Fertilizer Association, L. W. Howell of Swift & Co. was elected vice-president and Charles J. Brand was re-elected executive secretary and treasurer. New members of the board of directors are C. L. Ives, Newbern, N. C.; E. L. Robins, Meridian, Miss.; C. D. Shallenberger, Shreveport, La.; Bayless W. Haynes, Jacksonville, Fla., and L. A. Bailer, Savannah, Ga.

Chemical Engineers at Cleveland Discuss Cements and Rubber

Institute holds symposiums on chemically resistant cements and chemical engineering problems of rubber industry

Editorial Staff Report

IN THE first paper presented at the nineteenth semi-annual meeting of the American Institute of Chemical Engineers held in Cleveland, Ohio, May 31 to June 3, S. S. Sadtler reviewed the commonly used cements in a paper entitled "Cements and Lutes." The paper stressed surface preparation as being an important factor, since plane surfaces tend to form strong joints. Another desirable factor in cements is expansion on setting, as shrinkage may cause separation of the surfaces and weakening of the joint. Furthermore the cement should wet the surfaces thoroughly; otherwise there can be no strong bond. Cements were classified by the author as being either inorganic or organic. Under inorganic cements are plaster of paris, oxy-chlorides, portland cement, sodium silicate, basic phosphates, iron cements, sulphur and calcium hydroxide. Organic cements include rubber, gutta percha, resins, bitumens, drying oils, nitrocellulose cements, casein, glues, albumens and glycerine-litharge mixtures.

"Cements Used in Heavy Chemical Manufacture" by H. B. Bishop was read by title only, the author being absent. The paper contained three tables, the data of which are the result of the author's experience combined with that of the following co-operating companies: American Cyanamid Co., Kalbfleisch Corporation, Merrimac Chemical Co., Sterling Products Co., John C. Wiarda & Co., and Warner Chemical Co. The tables appear herewith in slightly condensed form.

A paper by F. W. Sperr, Jr., on "Cements for Gaseous and Liquid Hydrocarbons" was read by the Secretary in the absence of the author. The paper was a summary of cementing practice with respect to permanent joints in gas mains.

The list of cements ordinarily used in the gas and petroleum industries, in apparatus handling gaseous and liquid hydrocarbons, is short and simple. Only rarely does the plant technologist have to resort to other than the following materials familiar to every operator:

1. Red lead or white lead and linseed oil for "doping" screw joints. Oil-graphite mixtures are sometimes substituted.

2. Shellac has excellent resistance to the petroleum hydrocarbons at ordinary temperatures and is used for doping pipe threads in gasoline recovery plants.

3. Portland cement for gas main joints and miscellaneous repair purposes.

4. Litharge and glycerine—used principally for repairs or special joints in apparatus handling liquid hydrocarbons, or the vapors of such hydrocarbons.

5. Rust joint cements—usually consisting of iron filings and ammonium chloride—are sometimes used, although the writer had no direct knowledege of their application in these industries outside of the boiler plants.

6. Miscellaneous plastic materials, e.g., soap and clay, are employed in gas distribution systems for temporarily sealing breaks in mains.

A number of other materials, having excellent cementing properties, might well be employed; but their use in the gas and petroleum industries is very limited. Among these are glue base cements and sodium silicate compositions.

W. S. Crowell outlined the technology and applications of "Oxy-chloride and Other Dental Cements." Dental cements are of three classes: oxy-chloride, heavy-metal phosphate and silicate. The most recent development is the substitution of acid-soluble silicates containing aluminum for the copper or zinc compounds formerly used. The result is the silicate dental cement, which contains a large proportion of silicic acid gel and is much harder and stronger than the older forms. Oxy-chloride cements are used industrially when either a stronger or quicker setting cement than litharge-glycerine mixtures is desired. They are used in mounting small grinding wheels. Zinc phosphate cements have no industrial uses, but silicate cements have a small outlet in patching ceramic ware. Silicate cements are the strongest, the most translucent and show little or no shrinkage when kept moist, and the solubility is negligible. Copper cements are almost as strong, but they shrink more and are appreciably soluble. Zinc phosphate cements are about half as strong as silicate cements, shrink slightly and are nearly insolub'e. Oxy-chloride cements are about as strong as zinc phosphates.

Table I—Cements for Bondin ; Bricks

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Kind of Bond	Brick	Brick	Fire brick and tile	Brick to lead	Brick	Brick
Composition of cement	Duro cement	M. A. Knight acid-proof cement	Hytempite	Silicate of soda and silex	Dura-Stix.	Calcined magnesite
How made	Proprietary mixed with sodium silicate to consistency of cream	Proprietary mixed with sodium silicate to consistency of cream	Proprietary		Proprietary	Mixed with water to creamy consistency
How applied	Bricks are heated to about 150 deg. F. and laid with a thin joint	Bricks are heated to about 150 deg. F. and laid with a thin joint	Trowel		Mixed with sand as a paste	Bricks heated and laid with a thin joint
Application	Acids	Acids		Sulphuric acid		For fused and hot alkalies
Suitable range of temperature	0 to 300 deg. F.	0 to 300 deg. F.	To fusion point of brick		Range met in boiler settings	To fusion point of brick

Table II—Cements for Earthware, Chemical Stoneware and Fused Silica

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
Kind of Bond	Chemical and terra cotta stoneware	Chemical and terra cotta stoneware	Chemical and terra cotta stoneware	Chemical stoneware and fused silica tower and bell-and-spigot joints	Chemical stoneware and fused silica tower and bell-and-spigot joints	Chemical stoneware and fused silica tower and bell-and-spigot joints	Stoneware, glass and Duriron
Composition of cement	Silex and sodium silicate solution 40 deg.	Silex and coal tar	Fireclay and coal tar	Asbestos fiber, china clay, barium sulphate, melted pitch and coal tar	Asbestos rope is packed into joint	2 lb. caustic soda, 2 lb. water, 4 lb. linseed oil, 50 lb. silicate soda and 60 lb. china clay	Chemical Construction Co.
How made	By mixing to the consistency of dough	By mixing to the consistency of dough	By mixing to the consistency of dough	By mixing to a paste	Molten sulphur	Mix first four ingredients in order, then boil and while hot stir in china clay	Proprietary
How applied	By pressing into the joints	By pressing into the joints	By pressing into the joints	Over asbestos rope	Over asbestos rope	Troweled	As a paste
Application	Various mineral acids	Various mineral acids	Various mineral acids	Mineral acids; gases	Mineral acid; gases		Acids
Suitable range of temperature	Any range of temperature	Up to 200 deg. F.	Up to 200 deg. F.	200 deg. F.	250 deg. F.	0 to 150 deg. F.	Up to about 200 deg. F.

When used in contact with iron, rusting is promoted. The desired properties are high strength, low shrinkage and low solubility.

J. G. Vail discussed the chemistry of silicates of soda briefly, pointing out that a wide variety of properties is obtainable, depending upon the ratio of soda to silica. The high-soda silicates possess elasticity, and in solution they are relatively fluid and slow setting. The low-soda silicates are inelastic and quick setting. The relation of these properties to the cementing application is therefore of extreme importance and different compositions have been developed for the most common of the industrial applications.

Table III—Cements for Metal Joints

	No. 1	No. 2	No. 3	No. 4
Kind of bond	Iron to iron, iron to lead and lead to lead	Iron to iron, lead to lead and lead to iron	Glass and metal	Filling for holes and cracks in metal castings
Composition of cement	Red iron oxide free from silica, 5 parts and boiled linseed oil, 1 part	Red iron oxide, 2½ parts; barium sulphate, 2½ parts and boiled linseed oil, 1 part	Litharge and glycerine	Smooth Ore Mfg. Co.
How made	Mix oil into iron oxide	Mix oil into powder and to a thick dough	Mix to a thick cream	Proprietary
How applied	Paste		Brush	As directed
Application	Hydrofluoric acid; sulphuric acid	Hydrofluoric acid; sulphuric acid	Steam and oil	Steam, oil and alkalies
Suitable range of temperature	0 to 500 deg. F.	0 to 500 deg. F.	0 to 400 deg. F.	

THE RUBBER symposium was opened with a paper on "The Use of Solvents in the Rubber Industry," by R. P. Dinsmore and W. K. Lewis. Specifications for the principal solvents, benzene, gasolines, carbon tetrachloride and carbon bisulphide were stated, and the principal uses of solvents were briefly described. These are dipping, spreading, rubber-to-metal unions, rubber-to-cured-rubber unions, asbestos packing, adhesive and decorations, freshening the surfaces of unvulcanized rubber during fabrication and for the purification of certain rubbers. Methods for solvent recovery were outlined and the importance of inclosed drying equipment operating in an inert atmosphere such as flue gas was stressed.

During recent years many methods of recovery have been tried on large scale, particularly in the manufacture of so-called natural gasoline. Because of this experience the methods available and their relative advantages and limitations are now understood. In principle, the methods employed can be classified under four heads: cooling (with refrigeration where necessary), compression, absorption in liquid solvents and adsorption on solid absorbents. Furthermore, these methods may be used in all sorts of combinations.

Operating experience can be generalized in the following rules, the exceptions to which are relatively few: When condensation of the solvent can be brought about by lowering of temperature with cooling water alone, without the use of refrigeration, this is the cheapest method. Generally, however, the recovery is relatively incomplete and the cooled gas still carries considerable uncondensed vapor, both because of the high vapor pres-

American Institute of Chemical Engineers at Rubber Symposium, Cleveland, Ohio, June 1, 1927

sure of the solvent and because of its high molecular weight. When resort to refrigeration, applied in one form or another, is apparently necessary, it is usually cheaper to employ other methods. When the vapor concentration is very high, compression followed by water cooling is best; for lower but moderate vapor concentrations, the use of a liquid absorbent is superior. Because of the complications involved, these methods do not justify themselves unless the scale of operation is considerable. When vapor concentrations are very low, none of these methods can complete recovery, but in this case, the use of high efficiency solid absorbents has proven successful. These are peculiarly effective in cleaning up the last traces of vapor from a gas.

In a paper entitled "Rubber in Engineering," J. W. Schade stressed the point that the word "rubber" is as indefinite as the word "alloy." The rubber technologist has developed compounds having widely varying properties. Thus there are compounds resistant to abrasion for tires, heels and conveyor belt surfaces. On the one hand the rubber transmission belt has frictional resistance, and the rubber bearing lubricated with water has an extremely low frictional resistance. The relatively great impermeability of rubber to water and steam has been extended to other applications so that oily vapors and many common hydrocarbon liquids are now economically handled in rubber hose. The application of the Vulcalock process to chemical engineering equipment was cited.

"Hard Rubber for Chemical Industry" was discussed by J. R. Silver, Jr. Improved technology has produced hard rubber pipe that has resistance to breakage in handling; flanged construction is now possible with safety; ordinary pipe hangers may be used; and higher operating pressures are now possible. The author pointed out that the Vulcalock process was adaptable to hard as well as soft rubber equipment. A new material termed "Aeroboard" was described by the author. It is essentially a hard rubber product having a cellular structure high thermal resistance and light weight. It can be fabricated like wood, and it is designed to replace wood in many applications.

A paper of marked historical interest was that by W. F. Zimmerli on the "Development of the Auto Tire." The author estimates that tire service has increased at least five-fold during the past fifteen years, so that the tire of today makes about ten million revolutions and under all sorts of driving conditions. Among the important developments during the past twenty years the author cites rim design, bead design, the weftless carcass reinforcement, tire mold design, the water curing bag, compounding and curing of rubber and the low-pressure tire.

FOLLOWING the rubber symposium a short paper on "Inside Frosted Bulbs for Incandescent Lamps," was read by Marvin Pipkin. The process was developed by the Lamp Development Laboratory of the General Electric Co. and is now in operation on a full commercial scale.

W. L. Beuschlein discussed a new process for "The Carbonization of Soft-wood Sawdust in the Pacific Northwest." The carbonization of soft wood sawdust has been effected in the design, construction and operation of a semi-commercial rotating kiln. Use is made of the exothermal heat liberated by the decomposition of bone-dry sawdust. Excess heat is generated in the kiln through the admission of a controlled supply of air for the combustion of the products of decomposition. This heat is used for the pre-drying and pre-heating of the wood to the temperature of decomposition and also for the distillation of heavy tars from the charcoal. A yield of 80 per cent of charcoal of that obtained in an air excluded retort has been obtained. The charcoal is characterized by a high fixed carbon and low volatile content. The danger of spontaneous combustion has been almost entirely overcome by conditioning the charcoal in a current of air.

"The Three-electrode Vacuum Tube and Its Application to Some Chemical Engineering Problems," was presented by Harold C. Weber. The underlying principles and a few of the commercial applications of the three-electrode vacuum tube was discussed. To illustrate the diversity of uses for the method, a cable company is using the vacuum tube oscillator to follow the changes in rubber during vulcanization, a Boston manufacturer has apparatus available for controlling the thickness of coating materials, and this device is being used by a number of manufacturers of rubber sheet goods to maintain automatically a constant thickness of rubber on cloth. A pulp mill is using a similar device for maintaining a constant amount of moisture in the pulp passing over the rolls of the machines used for drying paper pulp.

A paper on the "Thermodynamics of Air Separation," by Barnett F. Dodge and Chenowith Housum, was read by title only, as the authors were absent. The paper analyzes the essential operations common to all liquefaction processes and shows that the present low energy efficiency of such processes is not likely to increase substantially. An increase from the present energy efficiency of 8 to 10 per cent to a future efficiency of 13 to 15 per cent appears to be possible with greater care in design.

A paper on "Inhibitors, their Behavior in Laboratory and Plant," was presented by F. N. Speller and E. L. Chappell. The paper applied specifically to the acid pickling of steel pipe. Plant and laboratory tests to determine the acid consumption both with and without inhibitors were conducted and the results show that large differences in acid consumption can occur in plant operation whether or not inhibitors are used. The results indicate that savings in acid may result from the use of inhibitors. However, no account has been taken of other factors in the use of inhibitors, which in many cases are more important than savings in acid. Among these may be mentioned the preservation of the metal surface, which is of importance in sheet works, avoidance of hydrogen embrittlement of wire and the reduction of fumes carried into the air by escaping hydrogen.

"Removal of Rust from Pipe Systems by an Acid Solvent" was the subject of a second paper by F. N. Speller, E. L. Chappell and R. P. Russell. Heavy incrustations of rust have been removed economically from building piping using strong, hot hydrochloric acid solution to which an inhibitor has been added to protect the pipe. The underlying variables have been investigated and the process should have a wide field of application.

The concluding paper of the program was "Heat Transmission by Radiation from Non-luminous Gases," by H. C. Hottel. As parts of this investigation will appear in an early issue of *Chem. & Met.* no abstract will be made at this time.

Modern Gas Production Methods

Well-attended first production conference of A.G.A. debates fundamentals of gas making and important trends of the industry

Editorial Staff Report

FUNDAMENTALS of gas production were thoroughly discussed in an unusually effective meeting under the auspices of the American Gas Association in Detroit, May 31 to June 1. About 300 engineers interested in coal-gas and water-gas manufacturing methods participated, making this first production conference an outstanding success among the many activities of the technical section of this association.

The conference was notable for its vigorous and spontaneous discussion of all the phases of gas making considered. And although in response to Vice-President W. C. Beckjord's appeal to deal with fundamentals it did go to the bottom of every question discussed, yet it was noted that at all points a practical workable application was demanded and no mere theory would satisfy the membership.

Since the Conference is a direct outgrowth of the work of the Carbonization Committee and the Water-Gas Committee of the Association it was conducted under the joint chairmanship of R. G. Porter and Henry Fink, the chairmen of these committees. H. W. Hartman, Secretary of the Technical Section of the Association, served as secretary and manager of the Conference proceedings.

The major problem of the gas industry today appears to be proper economic planning to care for peak loads of the future. The excessive height of these peaks in load as threatened for the future arises from the continual increase in house heating with gas. At the Conference it seemed to be the general sentiment that many companies are confronted with peak loads six times as great as base or minimum loads, and to supply gas for the base load coal gas is in general desired.

A SUMMARY was presented of the replies to the Association questionnaire regarding methods of handling base-load and peak-load gas, by A. W. Warner. It was pointed out that coal-gas units are not only largely used for base-load gas supply now, but that there seems to be a growing sentiment throughout the industry that base-load gas supply will eventually be from coal-gas equipment and that other types of manufacturing apparatus involving less investment cost per unit of capacity will be used for peak-load production. However, Mr. Warner did not undertake in his summary to make any generalizations or to give detailed reports of the present practice and the judgment of engineers on these important points.

In a number of cases coke-oven plants are now offering surplus gas for public-utility companies' use. This question offers particularly attractive possibilities to the gas company in avoiding new and large coal-gas plant investments. Such purchases are, however, not always feasible. In discussing the question of purchased gas it was pointed out that under certain circumstances the question of purifying, pumping, and mixing costs offset the low price advantage which would otherwise exist for such auxiliary supplies, even when they are of suitable quality and available in reasonable quantity regularly. It was urged that all of these auxiliary costs for mixing gas available be carefully considered when a purchase contract was contemplated.

As was pointed out by one of the speakers, "The industry wants the lowest over-all cost of gas in the holder." Anything which will contribute to that will be welcomed, especially by those executives who are confronted with serious electric, oil, or coal competition. In emphasizing the need for studying new systems with this in view it was pointed out, however, that there was no likelihood that existing water-gas plants would need to be scrapped, for such equipment will be needed to afford adequate peak-load manufacturing capacity and will afford such capacity with little or no new investment.

MUCH of the uncertainty as to the technical significance of gas mixing has been recognized by officials of the association as due to lack of knowledge of actual behavior of mixed gases in service. The association has taken steps to remedy this lack of information by an extended laboratory study which is being carried out in the central laboratory of the A. G. A. at Cleveland. G. B. Shawn, who is in immediate charge of this testing work, reported on the plans for this project.

It is proposed that the first study shall be made of the effect of specific gravity and related change upon appliance behavior. Water gas and coke-oven gas, each of about 550 b.t.u. are available and various admixtures of producer gas, blue-water gas, and natural gas are possible because of the strategic location of the laboratory. Tests will be made to determine the effect of changes in heating value, changes in specific gravity, and changes in chemical composition on typical burning appliances. The initial studies contemplate use of three types of ranges, three varieties of radiant heaters, three different styles of water heaters, one boiler, one muffle furnace, and one cutting torch. A three-year program of work along these lines is contemplated.

It was pointed out that it is practically impossible to carry to a satisfactory or definite conclusion most of the economic studies in progress under the association direction until the fundamental results of appliance behavior are obtained from this investigation.

The quantity of coke which can be sold for household purposes often limits the quantity of coal gas which can be made. Therefore, all interests who

desire to promote coal-gas manufacture in the industry are actively concerned with the development of coke markets.

THE results from a considerable number of practical operations had been summarized for the conference by A. M. Beebee in order to bring out the best present judgment as to what qualities of coke can and should be controlled in order to develop household markets. The following properties of coke are apparently regarded as of importance, more or less in the order in which they are stated: Size, ash quality, cleanliness, moisture, clinker tendency, volatile content, structure, strength, weight, appearance, sulphur content, and reactivity. Mr. Beebee's summary indicated the conditions which were controllable, either by coal selection, plant equipment, or method of operation, and outlined some of the types of coke handling which are now widely favored. A wide variety of sizing, screening, and handling was evident, but it was clear that there is a general concensus of opinion in favor of the maximum possible care in order to encourage the development of household coke markets.

The property of coke which seemed to develop the most discussion was that of reactivity or burning characteristics. J. D. Davis, of the U. S. Bureau of Mines, presented curves and photographs of further tests that have been conducted by the bureau on cokes made in the carbonization committee tests of gas plants during the previous year. The most important new feature pointed out by Mr. Davis was that dull coke appears to be distinctly more reactive than bright coke, whether considered from the standpoint of burning in air, or reaction with CO_2 or with steam in a water-gas generator.

IN CONNECTION with the development of coke markets one interesting experience was recorded of a company which finds it feasible to sell much of its coke as made, without stocking, by allowing a discount of $1.00 to customers who will take the coke at times of low demand. This company finds that the saving in handling into and out of the stock pile, together with degradation in size and actual losses, warrants this discount. Moreover such sales return the value of the coke promptly to the company and prevent capital from being tied up in storage.

A summary of replies to questionnaires was prepared by P. E. Eddy which showed recent experiences of operating companies with the qualities of oil now available. The replies disclosed that a very large number of companies had not found it necessary to change oil for several years past and they are still using very good grades. A few companies are, however, doing important pioneering in this field and it appears that the records of this work are going to be extremely valuable in aiding others when they are forced to such changes.

Dr. T. A. Mighill reported on a series of investigations which he has been making as to relative value of different series of hydrocarbons which occur in gas oils, particularly the paraffins, naphthenes, aromatics, and olefines. As a result of his work he recommended certain methods for determining the percentage of these constituents present in any sample. In the course of the discussion of Doctor Mighill's paper it was evident that operating engineers much prefer an oil of high paraffin content. It was pointed out that the carbureting value of this series of hydrocarbons is sometimes as much as three times as great as of the olefines and aromatics. Apparently the naphthenes have about 10 per cent less carbureting value than the paraffins.

In the course of the discussion one rather novel suggestion was made that many gas companies should undertake to buy oil which would give a higher tar yield because such companies get more for their tar relatively than they have to pay for their oil. The proponement of this idea pointed out, however, that this was probably not at all a typical condition throughout the industry but that each locality presented a different problem.

ONE of the most elaborate summaries of data presented to the conference was given on the subject of soft-coal operation of water-gas generators, by W. J. Murdock. This summary presented in detail operating results in thirty-nine particulars from twelve plants, several of them very large gas companies, eleven using Eastern and one Illinois bituminous coal. The data include for the first time full and satisfactory returns on the behavior of such coal in large diameter machines. Mr. Murdock, in summarizing the results, indicated that many replies to his committee show that water-gas manufacturers can use up to 50 to 60 per cent of bituminous coal without any trouble and that with suitable precautions and proper choice of coal 100 per cent bituminous coal operation is today completely successful in many works.

In connection with water-gas operations the subject of steam accumulators was considered also, particularly with reference to a report summarizing the experience of users which was presented by Mr. L. E. Knowlton. The reports so summarized related to such a variety of conditions that no general conclusions were offered, but it was made clear that high quality of steam is now being used extensively from accumulators over a wide variety of pressure ranges.

George E. Wagner presented a summary of replies regarding the use of liquid purification methods which showed wide differences of opinion as to the costs, the labor requirements, and the extent to which advantages offset what were in some instances increases in cost. In one particular, however, the replies summarized were unanimous, namely that the adjustment of liquid purification to meet changing load conditions is much easier than oxide purification.

IN DISCUSSING this report F. W. Sperr pointed out that the work of liquid purification had been done as a part of a large project to secure supplies of gas free from objectionable constituents. The effort is ultimately to furnish gas free from hydrogen sulphide, carbon bisulphide, oxygen, hydrocyanic acid, naphthalene, and water. He pointed out that liquid purification at once eliminated the hydrogen sulphide, most of the hydrocyanic acid, and the necessity for oxygen contamination. He forecast the development of a new process for carbon bisulphide removal and recalled the earlier work which he had reported on drying of gas and naphthalene removal. Thus he emphasized that the objective of a pure gas supply was not altogether out of the question in the relatively near future.

Penetrance of Oily Fluids in Wood

Neglected factors influencing penetration and absorption of creosotes, petroleum oils and creosote-petroleum mixtures

By A. M. Howald
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IN THE regular practice of pressure impregnation of timber, four important variables are taken into consideration, namely: pressure, time of treatment, condition of the timber as to species, seasoning etc., and the viscosity of the treating fluid. Of these variables, viscosity is the least tangible, and a large amount of experimental data have been published concerning the influence of this factor on penetrance. Viscosity considerations have become increasingly important in the newer processes of treatment involving petroleum oils, either to supplement zinc chloride treatment or in admixture with creosote.

In some of the earlier experimental work on penetrance in which viscosity was measured in arbitrary units (Engler), no consistent relationship was found between viscosity and penetration. For example, Bond states [F. M. Bond, *Proceedings American Wood Preservers Association*, pp. 216-74 (1913)] "that there was no apparent relation between the viscosity of mixtures of creosote with three carbon-free tars and the corresponding absorptions and penetrations into longleaf pine." Also, Teesdale and MacLean have reported (Clyde H. Teesdale and J. D. MacLean, *United States Department of Agriculture, Bulletin No.* 607, June 7, 1918) that "the relative viscosities of mixtures of coal-tar creosote and coal tar from different sources are not necessarily a true index of their ability to penetrate wood."

Later Bateman [Ernest Bateman, *Chemical and Metallurgical Engineering*, vol. 22, p. 359 (1920)], who was associated with the authors of the two publications just referred to, recalculated their results after translating their Engler numbers into absolute viscosity units (centipoises). He found definite relationships between viscosity and penetrance which could be expressed by empirical equations. For example, he states: "The following equations hold for longleaf pine and noble fir when the time of treatment is 2 hr. and the pressure 75 lb. per sq.in.:

Longitudinal penetration $yx = K$
Tangential penetration $yx^3 = K_2$
Radial penetration $yx^2 = K_3$

where x is the penetration, y the absolute viscosity, K, K_2 and K_3 constants." Bateman concludes this article with this statement: "That the measurement of the viscosity of oils intended for treatment is perhaps the most important measurement as far as penetrance is concerned."

More recently MacLean has further demonstrated the importance of the viscosity of creosote [J. D. MacLean, *Proceedings American Wood Preservers Association* (1927), (advance copy)], and of creosote-petroleum mixtures [J. D. MacLean, *Ibid*, pp. 147-164 (1926)], and even of aqueous solutions [J. D. MacLean, *Ibid*, pp. 44-71 (1924)] in determining the absorption and penetration obtained for given treating conditions of time and pressure.

The present article, while in no way minimizing the influence of viscosity on the penetrance of oils in timber, will show, however, that other factors obtain, dependent on the nature of the oil, and may be so much more significant than the viscosity as to obscure this latter as a factor.

We have had occasion to compare the penetrance of a large number of treating oils, and for this purpose have evolved a laboratory test apparatus permitting a comparison of two oils to be made in an hour or less. This apparatus consists essentially of a small steel cylinder 2½ in. x 14 ft. long, closed at one end with a high-pressure 2½-in. gate valve and connected through the other end by ⅛-in. pipe with a small hand pump and fluid reservoir for applying pressure. The whole cylinder is mounted vertically in a large water bath heated electrically to the treating temperature and thermostatically controlled. The cylinder, including three-quarters of the gate valve on top, is surrounded entirely by water and consequently kept at uniform temperature.

For laboratory penetrance comparison 1½x1½x11 in. heart Douglas fir specimens were used, obtained from 6-in. x 6-in. x 20-ft. seasoned straight grained all-heart Pacific Coast fir. From such stringers 11-in. lengths were sawed off and cut into 1½x1½x11-in. specimens as required, by ripping with a hand saw. For matching specimens the cross-section of a stringer was marked into 1½x1½-in. squares lettered from *a* to *p*. On completely cutting a 20-ft. stringer and allowing for waste at each end, there were obtained twenty specimens marked *a*, twenty specimens marked *b*, etc. Those specimens marked *m*, for example, came from the same cross-sectional position in the stringer, but from a different longitudinal position and were taken as matched specimens. Experience with Douglas fir, however, showed that this matching was unnecessary, as specimens from widely divergent positions in the stringer checked, when treated with the same oil under identical conditions, within ± 15 per cent of the average and usually within ± 10 per cent of the average, while the variation between different oils tested sometimes amounted to several hundred per cent.

The treating procedure for laboratory specimens was simple and occupied about 15 min. total time. The cylinder was nearly filled with treating fluid and allowed to come to 80 deg. C. (the temperature of the outside thermostatically controlled water bath), a specimen was then weighed and submerged in the fluid without pressure for 5 min., after which a pressure of 200 lb. per

This article is the report of one phase of the Institute's researches on wood preservation, 1923-1927, supported by the Grasselli Chemical Co., Cleveland, Ohio.

Table I—Laboratory or Small Scale Penetrance Comparison of Oil Mixtures

Description of Oil Mixture	Specific Gravity	Absolute Viscosity at Treating Temperature (Centipoises)	Absorption by Individual Matched Fir Specimens		Average Absorption Corrected to Unit Gravity (Penetrance)
			No. of Specimens	Grams Oil Absorbed	
I. Mexican and California petroleum oil mixture	0.86	5.77	14-a	15	17
			14-c	16	
			14-k	14	
			14-g	13	
II. Mexican petroleum creosote mixture	0.98	5 to 7	14-j	26	24
			14-a	25	
			14-g	21	
III. Pressure still petroleum creosote mixture	0.98	5.58	14-f	48	47
			14-m	48	
			14-k	41	
IV. California petroleum mixture.	0.87	5.91	14-c	14	17
			14-m	18	
			14-e	15	
			14-c	14	
V. Gulf lubricating oil kerosene mixtures	0.85	5.58	14-c	37	46
			14-m	41	
			14-h	34	
			14-b	39	
			14-m	33	
			14-e	41	
			14-c	46	
			14-j	38	
			14-e	40	
		4.90	14-j	40	46
			14-e	42	
			14-j	37	
			14-c	38	
		6.30	14-j	38	43
			14-b	38	
			14-j	35	
			14-e	35	

sq.in. was applied for 5 min.; the specimen was then removed through the 2½-in. gate valve, wiped dry and weighed to the nearest gram.

In many cases experiments on a laboratory scale as described above were duplicated on a larger scale. For this purpose a 12x36-in. vertical steel cylinder, electrically heated and thermostatically controlled, and fitted with a side arm of 2-in. pipe containing a screw for mechanical circulation, was employed. For treatments in this larger cylinder, matched specimens consisting of 30-in. lengths, either from 6-in. x 6-in. x 20-ft. stringers or 6-in. x 8-in. x 8-ft. x 6-in. fir cross-ties, were used.

In Table I results are presented showing the absorptions by laboratory specimens of four petroleum oil and creosoted-petroleum oil mixtures (I, II, III and IV), all compared with a mixture of pure distillate lubricating oil and kerosene (V) from Texas gulf coastal crude petroleum. It will be noted that the variations in average absorption amount to as much as 175 per cent, while the absolute viscosities, which were kept as nearly the same as practicable, varied less than 6 per cent between oils I, II, III and IV.

The effect of viscosity variations alone on the average absorption is shown by results recorded under oil V. For this mixture the ratio of lubricating oil to kerosene was purposely varied to give viscosity differences greater than those allowed between mixtures I, II, III and IV. It will be noted that with mixtures V, with a viscosity variation of 8 per cent, the variation in average absorption is only 7 per cent.

That great penetrance variations may exist between oil mixtures of different origin, and that these variations cannot be accounted for by viscosity differences, was verified by treatments of larger specimens in the 12x36-in. cylinder previously described.

In treating larger specimens the Lowry process was used. A specimen weighed to the nearest ¼ lb. was placed in the cylinder, which was then filled by gravity with oil from a reservoir at 90 to 95 deg. C., so that the cooling due to the cold specimen and cylinder brought it very nearly to the treating temperature of 80 deg. C. Air pressure was applied, starting at zero and gradually raised to 150 lb. per sq.in. during ½ hr. and held constant at 150 lb. for 3½ hr. The specimen was then removed and allowed to drip for 15 min., wiped dry, and weighed.

Matched specimens, either 24 or 30 in. long, were cut from three 6-in. x 8-in. x 8-ft. 6-in. cross-ties and one 6-in. x 6-in. x 20-ft. timber, all of air-seasoned all-heart Pacific Coast Douglas fir. The system used in numbering matched specimens was as follows: The three ties and the stringer were numbered 3, 4, 5 and 12, respectively. Specimens were numbered with the number of the tie or timber with sub-letters a, b, c, etc., to indicate successive specimens. That is to say, specimens 3 a, 3 b, 3 c, etc., are matched specimens from tie 3 and numbers 12 a, 12 b, 12 d, etc., are matched specimens from timber No. 12.

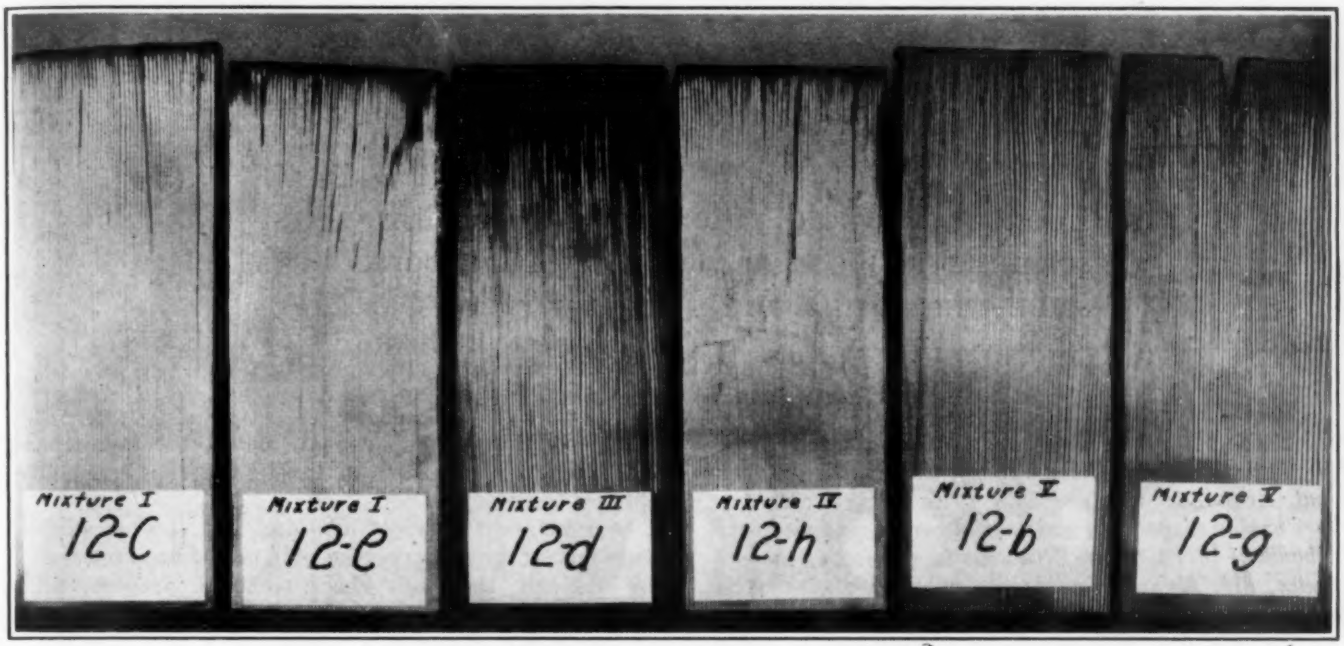
Table II gives a record of specimens treated and absorption obtained with five oil mixtures identical with those reported for small-scale treatments in Table I, except for slight differences in viscosity in some cases.

A comparison of the results given in Tables I and II will show that the same order of penetrance for the oils was found with small and large specimens, but that the relative difference was greater with the latter.

The great difference in penetrance of different oils due to their composition and not accountable for by viscosity differences are shown even more clearly by the larger scale treatments. For example, oil No. I, with a viscosity roughly 25 per cent lower than the viscosity of oil No. V, gave an average absorption of 1.40 lb. per cu.ft. in matched specimens from timber

Table II—Large Scale Penetrance Comparison of Oil Mixtures

Description of Oil Mixture	Specific Gravity	Absolute Viscosity at Treating Temperature (Centipoises)	Absorption by Individual Matched Fir Specimens			Average Absorption Corrected to Unit Gravity (Penetrance)
			No. of Specimen	Size of Specimen, In.	Absorption, Lb. per Cu.Ft.	
I. Mexican and California petroleum oil mixture	0.86	5.81	3-a	6 x 8 x 24	3.75	6.23
			4-a	6 x 8 x 24	3.33	
			5-a	6 x 8 x 24	9.00	
		4.47	12-c	6 x 6 x 30	1.20	1.40
			12-e	6 x 6 x 30	1.20	
II. Mexican petroleum creosote mixture	0.98	6.81	3-b	6 x 8 x 24	6.00	8.30
			4-b	6 x 8 x 24	6.75	
			5-b	6 x 8 x 24		
III. Pressure still petroleum creosote mixture	0.98	6.38	3-d	6 x 8 x 24	19.87	26.59
			5-c	6 x 8 x 24	32.25	
		5.44	12-d	6 x 6 x 30	12.80	13.06
IV. California petroleum mixture	0.87	6.20	12-h	6 x 6 x 30	2.80	3.22
V. Gulf lubricating oil and kerosene mixture	0.85	5.58	12-b	6 x 6 x 30	12.40	12.94
			12-g	6 x 6 x 30	9.60	



Specimens of timber showing penetration of various mixtures

No. 12, while oil No. V gave an average absorption of 12.94 lb. (almost ten times as great) in specimens from the same timber.

Penetration as measured visually showed the penetrance variations just as clearly. A photograph of one-half of a section cut longitudinally through each specimen from timber No. 12 is shown in the figure and gives a visual demonstration of the penetrance variations.

1. The rather generally accepted idea that the penetrance of creosotes, petroleum oils and creosote-petroleum mixtures in wood is determined by viscosity when the conditions of treatment are constant has been shown to be very misleading in some cases.

2. For example, of two oils of approximately the same absolute viscosity (the non-penetrative oil had the lower viscosity), the average absorption in matched 6x6x30-in. Douglas fir specimens was 1.40 lb. per cu.ft. in a 4-hr. treating period for one oil and 12.94 lb. per cu.ft. for the other.

3. The penetration differences measured visually were just as marked as the differences in net absorption by weight.

4. An experimental study of some of the causes of penetrance variation has been made and a subsequent publication is planned.

EDITORS NOTE—*This is the first of two articles from the Mellon Institute on this subject.*

Chrome Nickel Steel Containers for Acids

The annual report of the executive committee of the Manufacturing Chemists Association of the United States, June 1, 1927, embodied a report of the Steel Barrel and Drum Committee, from which the following is quoted as worthy of note by the chemical engineering industries:

Among the specifications revised and rewritten are those pertaining to steel barrels and drums. Specification 5-A covering steel acid drums, 55 and 110 gallon capacity, has been completely revised, several important changes being incorporated in the revision. In this work the committee has had the active co-operation of the Steel Barrel and Drum Makers Association of the U. S., as well as the aid of the Bureau of Explosives staff. Development of new packages and preparation of specifications to cover has formed an important part of the committee's work. Notable examples along this line are Specification 5, which was altered to include smaller gallonage drums to cover rubber cement, etc., desired by the rubber industry; Specification 42-B, covering aluminum drums for the shipment of inflammable liquids, desired by the chemical industry; changes in regulations and wording of I. C. C. specification 5-A to permit the use of a lead lined drum, 55 gallon capacity, for the shipment of phosphorus liquid compounds, desired by the chemical industry; Specification 5-D covering rubber lined steel barrels and drums for the shipment of muriatic acid, etc.

This committee also has made an extensive study of high chrome steels in their possible utilization for nitric acid drum construction. Sample drums have been put in experimental service by members of the committee and extensive test runs have been made in fabricating drums of Ascoloy. It has been demonstrated with practical certainty that alloys of this description will successfully withstand the action of nitric acid, subject, however, to definite limits in the sulphuric acid and hydrochloric acid content; such limits would not preclude use for commercial white nitric and strong nitric acids. The difficulty thus far encountered has been an apparent change in the structure of the steel at the welded joints. Recent test have tended to show the possibility of overcoming this defect through the addition of nickel. Drums recently constructed of steel containing approximately 17 per cent of chrome and 6 per cent of nickel have successfully passed I. C. C. 5-A tests. There are important possibilities in the development of this package (not overlooking the dangerous phase of it) which the committee is well cognizant of and continued attention and effort will be made toward successful development.

Geneva Conference Recommends Remedies for Economic Ills

Economists would rationalize industry through scientific methods and stimulate commerce by stabilizing tariffs and removing trade barriers

By Edward J. Mehren

Vice President, McGraw-Hill Publishing Co., Inc.

EDITOR'S NOTE. Chem. & Met., *as well as other McGraw-Hill publications, has been represented at the International Economic Conference by Edward J. Mehren, whose cabled dispatches and special correspondence form the basis of this article. Since the conclusion of the conference, Mr. Mehren has begun a study of industrial conditions in Germany, Italy and other European countries and his observations will be summarized in subsequent issues of* Chem. & Met.

CLOSING its sessions May 23 after three weeks of continuous work, the International Economic Conference meeting at Geneva, Switzerland, adopted a long series of recommendations for restoring the economic health of the world, particularly that of Europe. The principal resolutions affecting industry cover rationalization—that is the application of all scientific methods for reducing costs of production—the economic status and questionable value of international cartels, the use of industrial statistics and the various means of developing international commerce.

How speedily the recommendations can be translated into action, where definite action is proposed, can not be foretold. Immediate results must not be expected. The issues would require much time even if only national action were required, but there are various agencies for forwarding the work, such as the economic section of the League of Nations, the International Chamber of Commerce, the International Institute of Agriculture, and the International Management Institute. Further, meetings of responsible ministers of the various countries will certainly be convened to consider agreements on various points covered in the recommendations.

POOLS or cartels formed one of the dominant subjects of the conference and resulted in quite a divergence of views. The conclusion was that they must be considered as good or bad according to the spirit of their constitution and operation and the attitude of their managers toward the general interest. The field for such agreements, both national and international, is usually limited, so the conference declared, to branches of production already centralized and to products supplied in bulk or recognized grades.

Where applicable they can secure a more methodical organization of production, a reduction in cost by better utilization of equipment, the development of more suitable lines of new plant, a more rational grouping of undertakings, can check economic competition and reduce the evils resulting from fluctuations in industrial activity. By this means they may assure to the worker greater stability of employment, and at the same time by the reduction of costs and selling prices bring advantages to the consumer.

Nevertheless, the resolutions declared, if such agreements encourage monopoly and the use of unsound business methods, they may check technical progress and endanger the legitimate interests of sections of society and particular countries. Consequently such combinations should not lead to artificial rise in prices, which would injure consumers, and should give due consideration to the interests of the workers. They should not restrict the supply of raw materials or basic products to any particular country nor create unequal conditions between the finishing industries of the consuming and producing countries. Nor must they prevent the development in any country of industries which that nation considers indispensable.

On the question of control of pools the conference believed that international control of international pools cannot be set up. It recommends, however, that the League of Nations study these international pools, their effects on technical progress, on production, conditions of labor, supply and prices. This information, collected with the aid of the various governments, should be published. Such publicity is an effective means, on the one hand, of securing the support of public opinion for agreements which conduce to the general interest, and, on the other hand, of preventing the growth of abuses.

Incidentally any one interested in pools, whether national or international, would be well repaid by reading the six documents on the subject prepared for the economic conference. They can be secured from the League of Nations document agency, the World Peace Foundation, 40 Mount Vernon Street, Boston, Mass.

Opening Session of International Economic Conference at Geneva

RATIONALIZATION, in this series of articles, has been taken to mean all mechanisms for reducing cost of production and, therefore, the consolidation of industries has been included; this broad definition is in accordance with the German acceptance of the term. However, the conference limited it to scientific organization of labor, standardization both of material and of products, simplification of processes, and improvements in the system of transport and marketing.

While obvious to us in America, the conclusions are so important for Europe that they are given here in full:

"The conference considers that one of the principal means of increasing output, improving conditions of labor and reducing costs of production is to be found in the rational organization of production and distribution.

"The conference considers that such rationalization aims simultaneously:

1. At securing the maximum efficiency of labor with the minimum of effort;
2. At facilitating, by a reduction in the variety of patterns (where such variety offers no obvious advantage), the design, manufacture, use and replacement of standardized parts;
3. At avoiding waste of raw materials and power;
4. At simplifying the distribution of goods;
5. At avoiding in distribution unnecessary transport, burdensome financial charges and the useless interposition of middlemen;

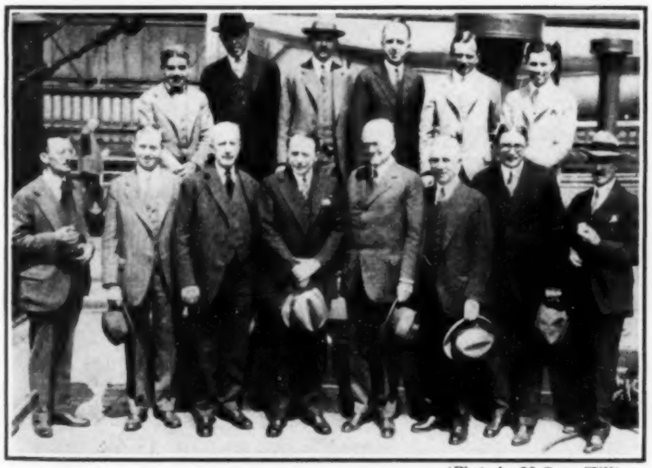
"Its judicious and constant application is calculated to secure:

1. To the community greater stability and a higher standard in the conditions of life;
2. To the consumer lower prices and goods more carefully adapted to general requirements;
3. To the various classes of producers higher and steadier remuneration equitably distributed among them.

"It must be applied with the care which is necessary in order, while at the same time continuing the process of rationalization, not to injure the legitimate interests of the workers; and suitable measures should be provided for cases where during the first stage of its realization it may result in loss of employment or more arduous work. It requires, further, so far as regards the organization of labor in the strict sense of the term, the co-operation of employees and the assistance of trade and industrial organizations and of scientific and technical experts.

"The conference accordingly recommends that governments, public institutions, trade and industrial organizations or public opinion as the case may be:

1. Should lead producers to direct their endeavors along the lines indicated above, and, in particular;
   a. To encourage and promote in every way the investigation and comparison of the most adequate methods and most practical processes of rationalization and of scientific management, and of the economic and social results obtained thereby;
   b. To apply these endeavors in industry, agriculture, trade and finance, not merely to large but also to medium and small undertakings, and even to individual workers and handicraftsmen, bearing in mind the favorable effects which they may have in household organization and amenities;
   c. To give special attention to measures of a kind calculated to ensure to the individual the best, the healthiest and the most worthy employment, such as vocational selection, guidance and training, the due allotment of time between work and leisure, methods of remuneration giving the worker a fair share in the increase of output, and generally conditions of work and life favorable to the development and preservation of his personality;
2. Should carry on systematically on an international as well as a national basis the standardization of materials, parts and products of all types which are of international importance, in order to remove the obstacles to production and trade which might arise from a purely national policy of standardization;
3. Should undertake on an international basis investigations for ascertaining the best methods employed and the most conclusive results obtained in every country in the application of the principles set out above, utilizing the investigations already made in certain countries and encouraging the exchange of information among those concerned;
4. Should spread in all quarters a clear realization of the advantages and the obligations involved in rationalization and scientific management as well as of the possibility of their gradual achievement."



(Photo by McGraw-Hill)

American Delegates to the Conference and the Expert Advisers Who Accompanied Them

Bottom row, reader's left to right: Henry Chalmers, chief of the foreign tariffs division of the Bureau of Foreign and Domestic Commerce; Dr. Arthur N. Young, economic adviser, Department of State; Roland W. Boyden of Boston, representing the International Chamber of Commerce; Dr. Julius Klein (delegate), director, Bureau of Foreign and Domestic Commerce, Department of Commerce; Henry M. Robinson (chairman of the delegation), President, First National Bank, Los Angeles; Norman H. Davis (delegate) formerly Assistant Secretary of the Treasury and Assistant Secretary of State; Alonzo E. Taylor (delegate), director, food research Stanford University; Dana Durand, chief of the research division, Bureau of Foreign and Domestic Commerce.

Top row, reader's left to right: Dr. Louis Dômeratzky, chief of the regional division of the Bureau of Foreign and Domestic Commerce; John P. Frey, editor, *Moulders' Journal*, advisor on labor questions; Edward Eyre Hunt of Washington, D. C., Department of Commerce; Grosvenor Jones, chief of the finance division, Bureau of Foreign and Domestic Commerce; E. W. Camp, commissioner of customs, Treasury Department, and W. L. Finger, Secretary to Dr. Julius Klein, serving as Administrative Aide.

In connection with industrial statistics, the conference recommended that international statistics be compiled on the supply of raw materials, on output, stocks, prices, wages and employment. It recommended a standardization of terms, methods and scope to begin with the basic world industries and those raw materials in which world shortage is anticipated. A continuation of the League's review of changes in world production and trade was also recommended.

RESOLUTIONS on commerce were very long and deserving of careful study by all interested in foreign trade. They condemn export and import prohibitions and special privileges granted to state enterprises. The conference recommended a liberal policy toward foreign nationals and companies engaged in commerce and urged a simplification of customs and tariffs and a standard nomenclature. The stabilization of tariffs by means of long term treaties, referring chiefly to European countries, was also recommended. It was declared that hampering tariffs should be reduced starting with those imposed to counteract the effects of war disturbances. It was recommended that the exportation of raw materials be not burdened by export duties and that such duties where necessary should not discriminate between different countries. Commercial treaties should contain an unconditional most-favored nation clause in the broadest and most liberal form. A uniform interpretation of said clause was urged. Further-

more all direct and indirect subsidies to home industries were condemned and dumping was declared harmful and out of all proportion to any temporary advantage from cheap imports.

Because American public opinion is opposed both to governmental participation in industry and to monopolistic tendencies, American delegates stated that while not opposed to resolutions on industrial pools they would abstain from voting thereon. There was no criticism or animosity to America and no evidence of a European combine against America. The contribution of American delegates was much appreciated for they took the position that they were here to help give the data requested regarding our experiences but not to tell Europe what to do.

* * *

EDITOR'S NOTE. *In order that the International Economic Conference might be supplied with specific technical as well as economic information on the present status of certain key industries, the preparatory committee of the Conference instructed competent organizations in the various countries to prepare a series of industrial monographs. Naturally the chemical engineering industries, including the production of heavy and fine chemicals, potash, fertilizers, rayon and coal processing, were the subjects of exhaustive memoranda. The United States, since it is a non-member of the League of Nations, was not consulted in the preparation of these monographs and these documents are of engaging interest, therefore, as representing the foreign appraisal of America's position in these chemical engineering industries.*

* * *

"The Monograph on the Chemical Industry" (League of Nations Document C.E.I. 10) consists of a 60-page statement prepared by Dr. C. Ungewitter for the *Fachgruppe Chemie Reichsverbande der Deutschen Industrie*, supplemented by a 30-page comment prepared by the Association of British Chemical Manufacturers and communicated to the conference by Sir Arthur Balfour. In addition it includes a chapter, "The Main Aspects of the Chemical Industry Throughout the World as seen from a French Viewpoint" by M. Duchemin, president of the *Union des Industries chimiques de France*, "Statistics and other information regarding the Italian Chemical Industry" compiled by the Honorable Ernesto Belloni and "Observations on the Chemical Industry and Rates of Duty Levied on Chemical Products Entering Poland" by M. Trepka, director of the Union of Polish Chemical Industries.

It is impossible to summarize or review this important document in the present limited space. It is significant to note, however, the statement in the German monograph that the total world output of chemical products increased in value from 10 milliards of gold marks in 1913 to 18 milliards of gold marks in 1924—an increase of 35 to 40 per cent when allowance is made for the depreciation in the value of gold. In 1913 the United States took 34 per cent of this production and Germany, 24 per cent; then comes Great Britain and France. Today the order remains the same but America's share has risen to 47 per cent while Germany's has fallen to 17 per cent of the total. In the 1913 production of aniline dyes, Germany and German branches in foreign countries accounted for 88 per cent of the total, Switzerland 6 per cent, Great Britain 3 per cent, United States 2 per cent and France 1 per cent. In 1924 Germany's share had fallen to 46 per cent, the United States was second with 20 per cent, Great Britain claimed 12 per cent, France 9 per cent, Switzerland 6 per cent, Japan 4 per cent and Italy 3 per cent. Comprehensive statistics of a similar character are given for sulphuric acid, nitrogenous fertilizers, superphosphate, pyrites, sulphur and sodium chloride. International price indexes based on gold value of 20 chemicals showed that while chemical prices had increased 21 per cent in Germany, 41 per cent in England and 32 per cent in the United States, they had fallen off 13 per cent in France during the 12-year period 1914-1926.

A significant statement in the German discussion of the coal-tar dye industry to which many Americans will take exception follows: "The possible world turnover in aniline dyes has remained unchanged since before the war, despite numerous old and new industries in existence. The possible turnover of each individual industry can therefore be only a fraction of the German industry before the war. The consequence is that there is now in each of these industries a thoroughly unsound ratio between overhead costs and current costs of production. Consequently in none of the new producing countries have the younger industries been able to maintain themselves out of their own resources. Not only has it been necessary in many countries to spend money on their maintenance, but the domestic market has had to be protected by high customs barriers, and in some cases import prohibitions have been required to regulate and restrict artificially the influx of foreign dyestuffs."

"The Potash Industry" (League of Nations Document C.E.I. 21) consists of three sections: A memorandum prepared by the *Deutscher Kali-Verein* of Berlin, a statement drawn up by *La Societe commerciale des Potasses d'Alsace* and a note on the Polish Potash Industry transmitted by M. H. Gliwic. In all, the monograph covers but 27 pages.

"The Artificial Silk Industry" (League of Nations Document C.E.I. 30) is a 51-page pamphlet, three-fifths of which are given over to a memorandum prepared by the *Associazione Nazionale Italiana Artificiale* communicated by M. de Stefani. This is supplemented by a brief statement prepared by the *Syndicat des Textiles artificiels* of Paris communicated by M. de Peyerimhoff de Fontenelle, observations on the German artificial silk industry communicated by Dr. C. Lammers and a brief on the Polish industry by M. H. Gliwic. Of the total world production of artificial silk in 1913 (11,000 kg.) the United States produced but 700 kg. while Germany accounted for 3,500 kg., Great Britain 3,000 kg., France 1,500 kg. and Belgium 1,300 kg. In 1925, when the world output had risen to 85,500 kg., it is interesting to note that 23,500 kg. or 27.49 per cent was made in the United States, the Italian production had increased from 150 kg. to 14,000 kg., Great Britain and Germany each contributed 12,000 kg. or 14.04 per cent of the total, France had a production of 8,000 kg. and Belgium, 5,000 kg.

"The tendency toward concentration in this industry," the artificial silk report concludes, "which led by Germany, has spread to the British and American industries, seems destined not to remain an isolated phenomenon but to be the first step toward a policy of agreements between the principal producing groups. Such a policy would tend to establish a relation as nearly constant as possible between consumption and production."

Tension Tests of Spot-Welded Duralumin

By T. W. Downes
Associate Metallurgist, U. S. Naval Aircraft Factory

ALTHOUGH the technique in joining duralumin sheets with the electric spot weld has not yet been developed to the point where the quality of the joints and their performance under severe service conditions can be predicted with certainty, welds which are tolerably satisfactory on certain classes of work are being employed commercially. Experimental work is being conducted with a view to improving the quality of the welds, and it is not improbable that as a result of properly directed research work the present difficulties will be overcome and that this method of joining sheet duralumin may some day compete successfully with riveting and other types of joint.

The present article deals principally with the tension and corrosion tests of electric spot-welded specimens of sheet duralumin which have been conducted at the Naval Aircraft Factory. Twenty-five specimens in each of four thicknesses of sheet, viz. 0.014 in., 0.029 in., 0.045 in. and 0.063 in., were used in the tests. These were prepared from specimens of sheet, size 3 x 1 in., which were welded together in pairs to produce specimens 5 x 1 in., having one spot weld at the center of the one-inch overlap. The welding was done on an automatic machine regularly used in welding steel, on which machine it has been found that the best results can be obtained in controlling conditions of time, pressure and current. In preliminary experimental work the best results were gotten by using a strip of steel about 0.30 in. thick on each side of the duralumin strips to be welded. This facilitates welding by concentrating the heat at the one spot, localized heating being promoted by the fact that the steel has both a higher electrical resistance and a lower heat conductivity than the duralumin. No flux was used on any of the welds.

Character of the Welds—Upon casual examination most of the welds appeared to be fairly uniform, approximately $\frac{3}{16}$ in. to $\frac{5}{16}$ in. in diameter and of neat appearance. One of the best of these is shown in Fig. 1 at a magnification of 6 diameters. Close examination with a hand lens, however, revealed the presence of cracks in the great majority and a porous condition in many of the welds. The cracks appeared to originate at the center of the welds and proceeded radially outward, there being as many cracks in one thickness of metal as in another. A typical example of cracking in a weld, magnified 6 diameters, is shown in Fig. 3.

The porous condition of the welds appeared to be more prevalent among those made in the thinner materials and in many cases was very severe. Many of the welds made in the thicker gages of sheet appeared to be quite sound, but the suspicion that the interiors of the welds were porous was confirmed later when the fractures were examined after the tension tests. It was then found that many of the welds which before the tension test had shown no indication of porousness at the surface contained many small internal pockets. This condition is shown in Fig. 2.

Heat Treatment of Specimens—Five specimens in each of the four thicknesses of metal were tested in the conditions as welded. The remaining twenty specimens in each of the four groups were heat treated and aged as follows, before being tested: (1) Heated for 20 min. at 500 deg. C. (932 deg. F.) in a molten mixture of equal parts of sodium nitrate and potassium nitrate, followed by quenching in water at about 60 deg. F. (2) Aged at room temperature for ten days.

Corrosion Tests—The third, fourth and fifth groups of five specimens in each thickness were exposed for periods of 100 hr., 30 days and 60 days, respectively, to the spray of a 20 per cent salt water solution. During these periods the specimens were examined at intervals and the progress of the corrosion noted both at and away from the weld.

It was thought that due to the physical differences which probably exist between the metal in the weld and the surrounding metal, that corrosion would be hastened at the dividing line between these areas and that in a relatively short time corrosion at this point would be markedly more pronounced than elsewhere. Contrary to expectations, however, such was not the case, and up to the end of 30 days' exposure little, if any, accelerated corrosion at or near the welds could be detected.

At the end of 60 days in the salt spray, however, increased corrosion was manifested in a number of specimens by the presence of a ring of pits around and concentric with the weld, about $\frac{3}{32}$ in. therefrom. This was in all probability the result of electrolytic action between two unlike physical conditions of the metal, and indicates that localized corrosion at electric spot welds in duralumin will persist to some extent even after heat treatment and aging. It is not clear just why this condition did not obtain for all specimens, but it is thought that this form of corrosion may have been masked by the severe pitting which occurred in areas of various sizes, throughout many of the specimens. These appeared to be areas of segregated impurities and occurred at the welds in a number of cases.

Tension Tests—At the expiration of the 60 days' salt-water spray corrosion test, all of the twenty-five specimens in each thickness of sheet were tested in

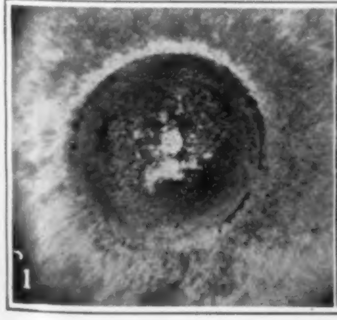


Fig. 1—Electric spot weld in 0.063 in. thick duralumin sheet. Magnified 6 diameters. Tensile strength in condition "as welded," 920 lb.

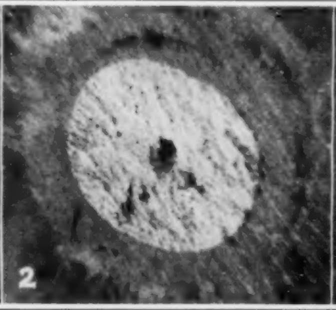


Fig. 2—Fracture of weld shown in Fig. 1, after tension test. Magnified 6 diameters. Shows blow hole and burned condition at center.

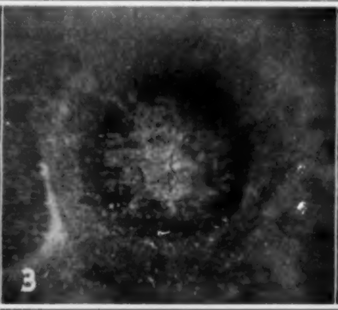


Fig. 3—Cracked condition in spot weld of 0.045 in. thick duralumin sheet. Magnified 6 diameters. Strength "as welded," 674 lb.

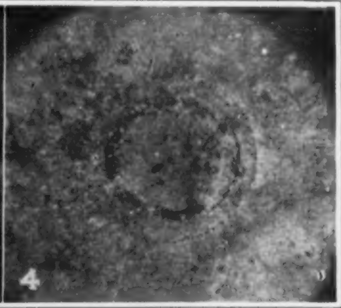


Fig. 4—Corrosion at heat-treated spot weld in duralumin sheet at the end of 60 days in salt-water spray. Magnified 5 diameters.

tension, the breaking load in pounds being determined.

The maximum, minimum and average breaking loads for each group of five specimens representing the four thicknesses of metal and the various conditions of the specimens when tested are given in Table I. Results of the tension tests were erratic, there being a wide variance in the results of the individual tests in all of the groups representing the twenty conditions of test, maximum values being from 16 per cent to 225 per cent greater than minimum values. This is construed as indicating that the welding technique has not yet been developed to the point where the strength of a welded joint of duralumin can be predicted with any degree of accuracy. In this connection, however, the quality of the material may also have had some bearing. Average values of the strength of the joints tested in the condition as received increased, as the thickness of the sheet increased, from a breaking load of 173 lb. for the 0.014 in. thick sheet to 882 lb. for the 0.063 in. thick sheet. The diameter of the spot weld increased as the thickness of the sheet increased. This and the fact that the method of failure changed as the sheet thickness increased probably account for the rather rapid increase in strength with increase in sheet thickness.

Failure of the joints occurred either by the weld being torn out of one member of the specimen, leaving a hole therein, and adhering to the other member, or by pure shear of the weld. The thinner materials generally failed in the former way and the heavier gage specimens in the latter way.

Heat treatment followed by aging effected an increase in the average strength of the joints except in the case of the 0.063 in. thick specimens. The increase varied from 34 per cent for the 0.029 in. material to 54 per cent for the 0.045 in. thick specimens. A loss in strength of 14 per cent was indicated for the 0.063 in. specimens, but because of the few specimens tested this is not regarded as conclusive.

Using the average areas of the welds and the average breaking loads for the five specimens in each thickness, the shear values in pounds per square inch for the 0.045 in. and 0.063 in. thick specimens as welded and after heat treatment and aging have been calculated. These values compare rather unfavorably with the generally accepted shear value of 30,000 lb. per sq.in. for heat treated and aged duralumin. The calculated values are given in the following table:

Shear Values of Spot Welded Joints (Pounds per Square Inch)

Thickness of sheet	As Welded. Not heat treated	Heat treated and aged 10 Days
0.045 in.	23,430	36,040
0.063 in.	23,210	19,900

The spot welds, tests of which are here described, probably represent as good practice as has been attained up to the present time in this work. The inherently unsatisfactory characteristics of the welds, however, are sufficient to preclude or greatly limit, for the present at least, the use of spot-welded joints to any extent for certain purposes, notably in the construction of aircraft, particularly on stressed parts.

No vibratory tests of spot-welded joints were made, but because of the cracks found in a great majority of the welds and the generally unsound and porous condition which obtained among the latter, it is considered that joints consisting of spot welds of the quality of those investigated represent a much less positive type than riveted joints, and would be unsuitable for use under conditions of alternating stresses.

From the standpoint of corrosion, the spot weld is considered to be inferior to the rivet. In the case of the rivet the main factor in promoting electrolytic corrosion is the physical difference set up within the rivet, and the rivet head and the material riveted, by reason of the cold, mechanical working received by the head. This can be eliminated, presumably, by proper heat treatment, and electrolytic action due to this cause thereby obviated. On the other hand, however, a spot weld represents an actual fusion of the metal, and its original condition is probably not restored by heat treatment, in consequence of which a condition favorable to electrolytic corrosion is unavoidable.

Spot welding of duralumin may, however, have possibilities in place of riveting on cowling and other parts not subjected to severe stresses. The spots could be placed close together and heat treatment could be applied subsequent to welding for the purpose of retarding corrosion as much as possible and improving the strength of the joint. The use of an electric air furnace for heating and the method of air quenching would minimize distortion of the work and probably improve the strength of the welds.

Breaking Loads of Spot-welded Duralumin, as Welded, After Heat Treatment, and After Heat Treatment Followed by Corrosion Tests

Specimen Thickness, in.	Specimen Nos.	Treatment received by specimens, after welding, before testing	Breaking load, lb. Max.	Min.	Ave.
0.014	1–5	None	216	136	173
	6–10	Heat treated. Aged 10 days	320	155	250
	11–15	Heat treated. Aged 100 hr. salt spray	172	121	146
	16–20	Heat treated. Aged 30 days salt spray	188	104	145
	21–25	Heat treated. Aged 60 days salt spray	260	80	170
0.029	38–42	None	580	336	466
	43–47	Heat treated. Aged 10 days	705	545	623
	48–52	Heat treated. Aged 100 hr. salt spray	596	440	528
	53–57	Heat treated. Aged 30 days salt spray	656	523	590
	58–62	Heat treated. Aged 60 days salt spray	670	412	580
0.045	63–67	None	810	512	656
	68–72	Heat treated. Aged 10 days	1,130	805	1,009
	73–77	Heat treated. Aged 100 hr. salt spray	1,135	980	1,051
	78–82	Heat treated. Aged 30 days salt spray	1,053	554	915
	83–87	Heat treated. Aged 60 days salt spray	1,025	745	931
0.063	106–110	None	1,079	668	882
	111–115	Heat treated. Aged 10 days	1,055	415	756
	116–120	Heat treated. Aged 100 hr. salt spray	1,050	500	755
	121–125	Heat treated. Aged 30 days salt spray	1,200	360	808
	126–130	Heat treated. Aged 60 days salt spray	1,392	240	1,049

Sulphite Cellulose Extract as a Tanning Material

Recently an investigation was conducted by E. L. Wallace and R. C. Bowker of the U. S. Bureau of Standards to determine the suitability of sulphite cellulose extracts, derived from the waste liquors discharged from paper pulp mills, for use in tanning hides for the manufacture of leather. The work included an analysis of various extracts for tannin content in comparison with vegetable tanning materials. Information regarding the combination of the tannins in these extracts with hide substance was derived from actual tanning tests on both hide powder and pieces of raw hide.

The results show that these extracts contain materials absorbable by hide powder in quantities which compare favorably with the amounts found in the ordinary vegetable tanning materials. Tanning tests on light skins show that the extracts are satisfactory in so far as color is concerned. Tests with hide powder showed that the materials in these extracts available for leather making are firmly held by hide substance, and actual tanning experiments with hide pieces demonstrate that they have a satisfactory tanning value, particularly when blended with other vegetable extracts.

Economic Development of the Sulphuric Acid Industry

American progress since 1900 reflected in increased efficiency and remarkable growth to dominating position in world industry

By Theodore P. Kreps
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Harvard University

THE last twenty-five years, 1900-1925, witnessed many extraordinary technical and economic developments in the American sulphuric-acid industry. Several important economies were effected in the technique of the chamber process. Contact-acid production became commercially profitable. The tonnage of oleum manufactured grew from almost nothing to a figure comprising nearly one-third of the total. The zinc and copper smelters first began to put out by-product acid in relatively large quantities. Another cycle in the use of sulphur versus pyrites was completed. At the beginning of the period almost 90 per cent of the total acid produced was used for manufacturing fertilizer, pickling steel, and refining petroleum. At present only 55 per cent is so consumed. Although the number of establishments producing sulphuric acid increased by only 40 per cent, their output increased over 600 per cent in tonnage, and about 400 per cent in value. In 1902 the American industry was hardly equal in stature to that of Germany or England. In 1925 the United States produced over three times as much sulphuric acid as any other country in the world. Such, summarily stated but now to be briefly explained, were the extraordinary changes in the industry during the last quarter century.

In 1900 much was hoped for from the contact process, and much feared from it. Winkler expressed the enthusiasm of many fellow technologists when he wrote that "in no distant time lead chambers will be dispensed with." As it proved, the two processes became complementary. The field has been divided between them.

In the first quinquennial period of the present century several American firms experimented with the contact process. Dr. Charles E. Munroe points out in Bulletin 92 of the Census for 1904 that the first plant to be constructed in this country used the Grillo-Schroeder patents. This was in a contact works of the New Jersey Zinc Co., and was put into operation at Mineral Point, Wisconsin, in 1901. Of the nine new contact plants built in the period 1900-03, six used the same process. He adds, however, that Schoellkopf, Hartford, and Hanna were developing the Mannheim patents in a plant at Buffalo in 1903. By 1906 the Tentelew process was found feasible by the Merrimac Chemical Co. The General Chemical Co. controlled the Badische patents. Several other firms tried out some one or other of the above forms of the new method. The Badische and Schroeder processes were most favored.

The writer wishes to express his indebtedness of Professor F. W. Taussig of the Department of Economics and Professor Grinnell Jones of the Department of Chemistry of Harvard University for valuable assistance in the preparation of this article.

The outcome was that Winkler's prophecy, as was noted above, never came true. The contact process did prove less expensive for the production of acid of high concentration and purity. But the chamber method of manufacture continued to be better adapted to bringing forth acid of low strengths.

This was in part due to the fact that, under the pressure of competition, many improvements were introduced into the old mode of manufacture. Rule-of-thumb procedure became more generally superseded by

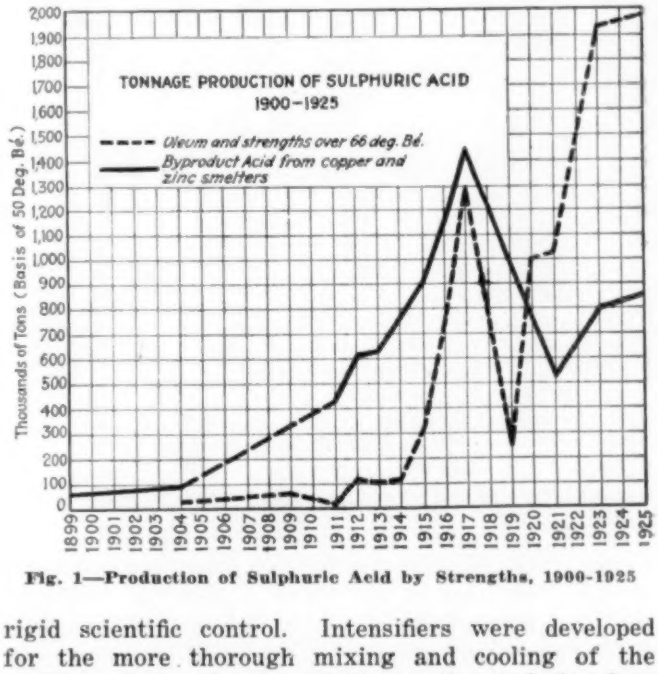

Fig. 1—Production of Sulphuric Acid by Strengths, 1900-1925

rigid scientific control. Intensifiers were developed for the more thorough mixing and cooling of the chamber gases. In many instances the lead chambers were built higher, and the Gay-Lussac towers enlarged. Machinery and automatic devices of every contrivance, such as water sprays, acid lifts, and fans, became more generally used. The net result was a 20 per cent decrease (making corrections for changes in the prices of labor, materials, and capital) in the cost of production of sulphuric acid by the old process.

A second factor substantially helped the chamber process to retain its competitive vigor. Prior to 1914, over 50 per cent of the sulphuric acid produced was ordinarily consumed in the manufacture of fertilizers, primarily phosphates. In these products a normal amount of such impurities as arsenic, or lead, is innocuous. Impure chamber acid of the required concentrations was no less suitable than pure contact acid. Competition, as far as fertilizer uses were concerned,

took place almost wholly on the basis of price. This placed the new method at an economic disadvantage, because, as Knietsch had discovered, impurities must be carefully removed, at considerable expense if the catalyst in the contact mass is to be kept active and the process continuous. Therefore, the chamber process continued to supply practically all of the industrial demand for weak sulphuric acid.

It is patent that the growth of the contact process depended very largely on the development of a demand for acid of concentrated strengths, such as oil of vitriol and oleum. The older method was clearly at a disadvantage here, since a substantial cost of concentration had to be incurred to produce acid of such strengths. Prior

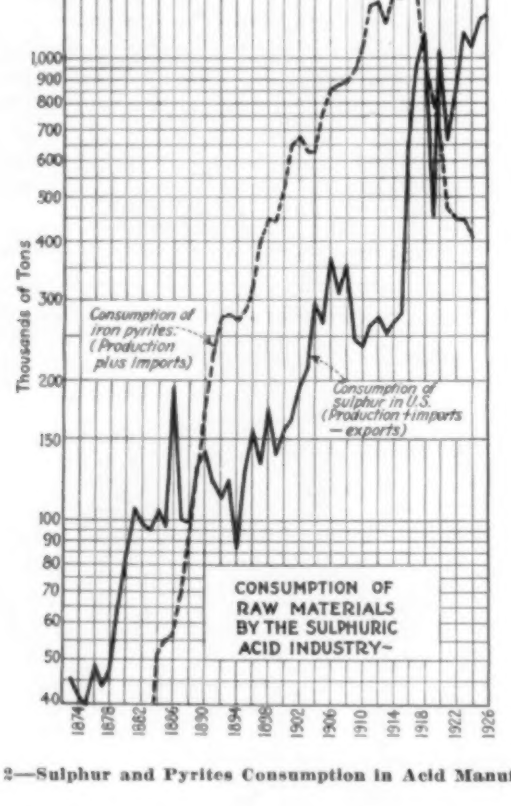

Fig. 2—Sulphur and Pyrites Consumption in Acid Manufacture

to the World War there existed no large demand in the chemical industry of the United States for such acid. As far as oleum is concerned, production did not expand with any rapidity (see Fig. 1) until the Great War, when the nations of Europe, and ultimately our own country, became insatiable customers for explosives. The present status of the industry, on the other hand, is primarily due to the extraordinary post-war growth in the production of artificial dyestuffs, nitrocellulose lacquers, petroleum products, other acids and chemicals generally. The table below reveals in a fragmentary way the development of the contact industry since 1914. In 1923 it accounted for nearly 30 per cent of the total sulphuric acid made in the United States.

Year	Number of Establishments Contact	Chamber	Both	Number of Tons Contact	Chamber	Both
1914	13	172	9	698,413	2,461,815	411,338
1919	24	185	7	1,141,418	3,757,887	653,276
1921	Not given by census			1,102,567	3,276,324	......
1923	34	151	..	1,812,341	4,743,176	......

THE technical literature of the nineteenth century had generally urged the recovery of sulphur dioxide from smelter gases, but the first considerable development of a by-product acid industry in this country occurred in the period here under review. It is true that as early as 1895 the Matthiessen and Hegeler zinc company at LaSalle, Ill., began to make sulphuric acid from zinc ores. But the industry got its most significant impetus about 1905.

As it happened, however, not zinc ores, but pyrrhotite ores and blast furnace gases from semipyritic smelting of chalcopyrite ores became the important raw materials. This resulted from a decision of the Federal Court, which was handed down in the case of the State of Georgia vs. the Tennessee Copper Co. and the Ducktown Sulphur, Copper and Iron Co. The Tennessee Copper Co. in 1907 entered the field as one of the largest, if not the largest, producer of sulphuric acid in the world. Other companies also began to produce acid from copper concentrates, cuprous pyrites, etc., so that by 1911 by-product acid comprised about one-sixth of the total acid produced. This fraction remained roughly the same until very recent years as will be observed from the curves in Fig. 1. Byproduct acid in 1925 constituted less than one-eighth. In part this may have resulted from the decrease in the number of plants which make sulphuric acid from zinc and copper ores, for there were only 15 in 1923 as compared with 20 in 1914. But the slump in the fertilizer industry and the unusual growth of the dye and general chemical industries also help to account for the failure of by-product acid production to keep pace with the industry in general in recent years.

THERE are at present certain conditions which seem to indicate that the past twenty-five years have constituted another one of the cycles in which sulphur and pyrites have tended to displace each other as raw materials. The price of sulphur has been advanced. Imports of pyrites are beginning to increase more and more. The same statements could have been made thirty years ago. Then the industry had been adapting itself to the use of pyrites and was still very busy in the process. In 1895 about 75 per cent of the acid produced had been made from brimstone; whereas in 1902 only 20 per cent was thus made. By 1914 but 2.6 per cent of the total acid production was obtained from brimstone, and 73.7 per cent from pyrites. In 1919, however, the trend had again been reversed, for then 48.7 per cent of the total was produced from sulphur. At present probably two-thirds of the sulphuric acid made in the United States derives from sulphur. The industry has approximately come back to the raw material situation of 1895.

A comparison of the curves in Fig. 2 is instructive, if due caution is observed. Both sulphur and, to a less degree, pyrites are consumed for other purposes than for the manufacture of sulphuric acid. Making due allowances, however, one can derive from a careful correlation of the year to year fluctuations in the two curves a fairly general although rough indication of the varying fortunes of these two raw materials in the sulphuric-acid industry.

To record the dramatic episodes in the international distribution of sulphur production; to recall how Louisiana and Texas displaced Sicily as a source of sulphur; to relate how an American invention contributed to a couple of near-revolutions in Sicily, and helped to pro-

duce the present political ferment in Spain and Portugal —all this does not lie within the scope of the present paper.

TURN now to the matter of industrial organization. Beginning with the horizontal combination in 1899 of about a dozen sulphuric-acid plants into the General Chemical Co., consolidation and expansion continued throughout the period. Several firms built, or bought up, plants scattered through the country. In 1920 the movement culminated in the organization of the Allied Chemical and Dye Corporation; capitalized at roughly $350,000,000 and one of the largest in the world. Other corporations, like du Pont and Grasselli, grew to a somewhat similar size by the construction, outright purchase, or control, of many small plants in all parts of the country, as well as by the enlargement of the individual plants.

Combination in the sulphuric acid field was not only horizontal, but vertical as well. It had consequences beyond the mere enlargement of the several concerns. Integration which went on through the period, made possible a greater diversification of output and the satisfaction of several kinds of demand for chemicals. Correspondingly greater stability of business was promoted. Freedom from dependence on industries formerly furnishing basic and intermediate materials was achieved. Greater financial strength and more adequate facilities for progressive intensive research diminished considerably the risk which always attaches in the chemical industry to new and revolutionary discoveries and inventions. Moreover, economies resulted from a better exploitation and marketing of by-products and main products. Therefore, as compared with 1902, many firms in the sulphuric acid industry now put out twenty times as many products, and some have increased the number literally a hundredfold.

As regards the technical efficiency of the industry, it appears from the census reports that, in the sulphuric, nitric, and mixed acids industry proper, the physical output per worker has increased from a little over 200 tons in 1899 to nearly 980 tons in 1925. This, of course, is not representative of the industry generally, yet it is noteworthy, that for example, since 1899 the number of all establishments manufacturing sulphuric acid has increased by only one-fifteenth of the rate at which their output has expanded. (See Fig. 3). Further, a careful comparison of the curves shows that, with the exception of the abnormal war-period, the money value of the acid has not increased proportionately with the volume. This is the more worthy of attention when one considers that the general price-level roughly doubled during the period. True, the price of sulphur declined somewhat, particularly in the post-war period, yet, the prices of all the other items used in the manufacture of sulphuric acid rose, and annual wages, at least in the sulphuric, nitric, and mixed acids industry proper, rose from an average of $570 per worker in 1899 to roughly $1,400 in 1925.

By way of conclusion a comparison of the American sulphuric industry with those abroad may prove illuminating. Thorpe's "Dictionary of Applied Chemistry" gives a table which shows that in 1902 the consumption of pyrites in the United States was roughly equal to that in England and Germany. England was outdistanced by 1905, and Germany by 1912, as far as the production of sulphuric acid is concerned (assuming that data on the consumption of raw materials warrant general statements as to the status of the industry). In 1925 the United States manufactured nearly one-half (45 per cent) of the total sulphuric acid produced in the world. The table below speaks for itself. It is taken from the recent monograph on the chemical industry prepared for the International Economic Conference and published by the League of Nations. This shows the readjustment brought about in the economic conditions of Europe since 1913, but shows even more clearly the new position of the United States. It is significant that while the total has risen by 25 per cent, the production in Germany and Great Britain has fallen, in the latter case amounting to 33 per cent. The output of the United States, on the other hand, exactly doubled during this period.

If it be true, as Liebig was wont to say, that the production of sulphuric acid goes far to indicate the industrial status of a country, the table strikingly portrays the progress made by the United States as compared with that of the less fortunate members of the family of nations.

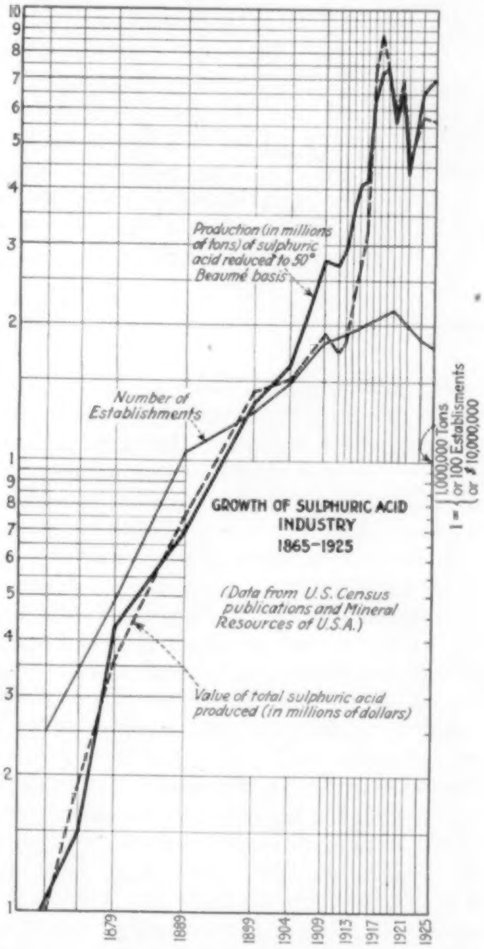

Fig. 3—Number of Establishments, Production and Value of Output by Sulphuric Acid Industry, 1865 to 1925

Country	Sulphuric Acid Production, 50° Bé. Basis 1913 1,000 Metric Tons	1925 1,000 Metric Tons
Germany	2,700	1,800
Great Britain	1,800	1,300
United States	3,150	6,300
France	1,480	1,840
Belgium	580	740
Holland	60	150
Poland and Danzig	100	320
Spain	....	230
Denmark	100	175
Sweden	135	140
Italy	770	1,075

Industrial Position of NEW ENGLAND

As a Location for Chemical Industry

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IN ANY CONSIDERATION of the industrial situation in the six New England states, it should be remembered that in general the three northernmost of these, Maine, New Hampshire and Vermont are mainly agricultural. There are, of course, notable exceptions in the large pulp and paper plants in Maine, certain large textile developments in southern New Hampshire, and large chemical and pulp plants in the northern part of the same state. It is nevertheless true that at present the three southern New England states, Massachusetts, Rhode Island and Connecticut account for 86 per cent of the value of New England manufactures.

It requires no deep analysis of New England's industrial situation to realize that the widely diversified industries which exist in this small corner of the United States are not here because of abundant raw materials, but rather because of other compensating factors which will be considered later. So far as mineral raw materials are concerned, the most important are limestone and marble, quartz, feldspar, mica, granite, talc and clay. There are also large deposits of semi-graphitic coal, and although economic conditions do not permit of their profitable working at the present time, some use will doubtless be found for them. The soils of New England are of glacial origin and therefore in many cases stony, but for this very reason their continued fertility is assured because of the fertilizing constituents which are slowly but steadily released by the action of the weather. Dairying, poultry farming, apple growing, and timber raising will doubtless long flourish in New England. One of the large uses for timber in New England is as a raw material for wood pulp and paper manufacture, the fourth largest New England industry. A number of the larger pulp and paper manufacturers have taken advantage of the soil raw materials to ensure a continuing wood supply by reforestation. Furthermore, this is one of the few New England industries that derives its raw material largely from New England.

There is one raw material required by practically every industry, in which New England is particularly fortunate, and that is water. In general the water is not hard and although there is the usual seasonal variation in flow, almost all the rivers and streams furnish sufficient water even in summer to meet the requirements of the sizable industries on their banks. Except where polluted by manufacturing wastes, these waters require relatively small amounts of chemicals for treatment, and in some of the worst instances of pollution by waste, the concerns responsible are already taking steps voluntarily to take care of the objectionable waste before it enters the water.

Another advantage of New England water is that even in summer it does not get unduly warm, making it useful the year round for moderate cooling, as for example in condensers. This, of course, is particularly true of the ground waters.

The chief New England talc deposits are in Vermont but the total output had an annual value of only a little over $530,000 in 1925. The states of Maine, New Hampshire and Connecticut produced 75,900 long tons of crude feldspar in 1924 which was 38 per cent of the total production for the country. New Hampshire is one of the two chief mica producing centers of the United States. New England clay is chiefly used for the manufacture of brick.

The materials produced in New England are of a varied nature and to consider all of the industries is manifestly out of the question in a brief article. Accordingly, a line has arbitrarily been drawn at those industries or groups of industries whose products have an annual value of at least $50,000,000 and only those are considered which are above this figure. Unfortunately this excludes some important groups and some large individual plants. For example, one of the nationally known soaps and the country's most expensive automobile are manufactured in Massachusetts. In the same state is also located one of the largest plants manufacturing artificial abrasives and related products. The carbonated beverage industry is prominent, including as it does two brands which are distributed all over the eastern part of the United States. Furthermore, there are three producing and two experimental rayon factories in New England, as well as one of the largest plants in the country devoted to the conversion of rayon threads and yarns into the forms required by

the textile industry. Of the five pyroxylin plastic plants in the United States, two of the largest are in New England.

Although again not coming strictly above the $50,000,000 limit, there are several other significant industrial developments to which reference should be made. For instance there are large sugar refineries in New England and the manufacturing and executive headquarters of the largest chain of retail drug stores in the country is in Massachusetts. Oil refining is a growing industry in New England and is already one of the largest consumers of sulphuric acid in this territory. A New England chemical manufacturing firm has developed a process for the manufacture of building blocks from waste byproduct gypsum which has not only been in successful operation here for several years, but which gives promise of being applied with equal profit in other parts of the country.

New England is one of the largest centers of the fishing industry in the United States and while this is not ordinarily classed as a chemical industry, there is noticeable among the more progressive firms an awakening to the fact that chemical research would seem to offer as great possibilities for them as it has already demonstrated in the case of the meat packing industry. In other words, a systematic study of the fish industry from the chemical and biochemical points of view would undoubtedly produce much of value, not only in the way of increased utilization of byproducts, but also along the lines of improvements in the handling of the fish itself. In fact, the beginning of such a study has already been under way for nearly a year in one of the New England research organizations and while the results so far are largely of a preliminary character, they give promise of distinctly valuable developments.

Table I

New England Products with an Annual Value of $50,000,000 or over.
Data Assembled from Biennial Census of Manufacturers, 1923

Industry	New England*	United States*	Per Cent of Total N. E. Mfrs.	Per Cent of U. S.
1. Cotton manufactures	$775,209	$2,010,141	12.1	38.6
2. Worsted goods	446,851	698,270	7.0	64.0
Woolen goods	240,678	354,287	3.7	66.1
Combined	687,530	1,062,558	10.7	64.7
3. Boots and shoes, other than rubber	388,770	1,000,078	6.0	38.9
4. Paper and wood pulp	258,592	907,346	4.0	28.5
5. Foundry and machine shop products not elsewhere classified	229,045	2,337,073	3.6	9.8
6. Electrical machinery, apparatus and supplies	202,967	1,293,001	3.2	15.7
7. Rubber boots and shoes	77,442	131,739	1.2	58.8
Rubber tiers and inner tubes	62,086	644,193	1.0	9.6
Rubber goods not elsewhere classified	58,211	182,584	.9	31.9
Combined	197,741	958,517	3.1	20.6
8. Brass, bronze and other Nonferrous alloys and manufacturers of these alloys and of copper	188,680	511,470	2.9	36.9
9. Dyeing and finishing textiles	160,269	342,229	2.5	46.8
10. Printing and publishing	159,857	2,021,355	2.5	7.9
11. Silk manufactures	139,718	761,322	2.2	18.4
12. Textile machinery and parts	102,767	140,661	1.6	73.1
13. Bread and other bakery products	100,616	1,122,906	1.5	9.0
14. Hardware not elsewhere classified	87,861	215,960	1.4	40.7
15. Knit goods	84,390	848,176	1.3	9.9
16. Leathers, tanned, curried and finished	78,350	488,897	1.2	16.0
17. Jewelry	68,725	174,034	1.1	39.5
18. Slaughtering and meat packing (wholesale)	62,421	2,585,804	1.0	2.4
19. Gas, manufactured, illuminating and heating	59,889	450,097	.9	13.3
20. Confectionery	51,925	366,255	.8	14.2
All others	2,335,175*	40,958,110*	36.4	5.7
Total Value	6,419,975*	60,555,998*	100.0	10.6

* Figures given in thousands.

Altogether there are 209 different lines of manufacturing activity in the New England states listed in the Biennial Census of Manufactures for 1923. Of these the twenty most prominent from the point of view of value of products are listed in Table I and these are the ones to which attention must necessarily be confined in this article.

These diversified lines of manufacturing require a wide variety of chemicals. Some of the more important inorganic chemicals are listed in Table II, while some of the organic materials which are used in considerable quantities are given in Table III.

Table II

Inorganic Chemicals Required by Leading New England Industries

Acids
(a) Sulphuric
(a) Hydrochloric
(a) Nitric

Bases
(a) Lime
(a) Caustic Soda
(a) Ammonia

Miscellaneous
(b) Sulphur
(a) Chlorine and Hypochlorite
(b) Carbon Black
(b) Zinc Oxide
(a) Talc
(a) Clay
(a) Sand
(b) Common Metals and Alloys

Salts
(b) Sodium Chloride
(a) Ammonium Sulphate
(a) Glauber's Salts
(a) Salt Cake
(a) Nitre Cake
(b) Soda Ash
(b) Sodium Bicarbonate
(a) Sodium Bisulphate
(a) Aluminum Sulphite
(b) Sodium Bichromate
(b) Basic Chromium Sulphate
(a) Antimony Sulphate
(a) Calcium Carbonate
(b) (English Cliffstone)
(b) (Paris White)

(a) indicates that the material is produced in New England.
(b) indicates that the material is not produced in New England.

Table III

Organic Chemicals Required by Leading New England Industries

(a) Acetic Acid
(b) Oxalic Acid
(b) Tanning Barks and Extracts
Oils for Leather and Tanning

(a) Cod oil
(b) Neatsfoot oil
(a) Sulphonated, oil, etc
(b) Vegetable Oils
(a) Denatured Alcohol
(a) Accelerators for Rubber

(a) Soap
(b) Waxes
(a) Casein
(b) Rosin
(b) Shellac
(a) Glue
(a) Starch, Potato
(b) Starch, Corn
(b) Starch, Tapioca
(b) Dextrines

(a) indicates that the material is produced in New England.
(b) indicates that the material is not produced in New England.

It may be of interest to consider in a general way the supply and demand situation for those of the above chemicals which are produced in New England.

Mineral Acids—All three of the common mineral acids, sulphuric, hydrochloric, and nitric, are produced in New England. In fact, there are six sulphuric acid plants and the production in this territory is more than ample to take care of the market demand. The uses of sulphuric acid in New England are increasing, particularly for oil refining and for byproduct ammonia.

The market for hydrochloric acid is relatively small in New England and the present production is more than enough for the New England demand. Of nitric acid, there are two manufacturers in New England. The use of this material, however, seems to be falling off. The principal use is as mixed acid for the nitration of cellulose, though there is a small amount used in the jewelry industry.

Bases—There are a number of plants producing lime in New England particularly in Maine, Vermont, and western Massachusetts. There are no figures available, however, to indicate whether the production in New England is adequate to take care of the New England demand, but there is a general impression that one about balances the other.

There is one plant in New England which produces caustic soda electrolytically, but the production of this plant is not sufficient to meet the needs of the district and caustic soda is brought in to this territory from other sections.

THERE are five producers of aqua ammonia in New England, three of whom are gas companies and the other two are chemical manufacturers. Practically all of the gas liquors in New England are run through to recover ammonia and the supply is ample to take care of the market, even though the demand from the textile industry is a large one. In this connection, it is interesting to note that no anhydrous ammonia is produced in New England, it having been driven from the field by the synthetic product which is not manufactured in this territory.

Salts—The demand for ammonium sulphate in New England is relatively large and comes chiefly from its use in connection with the growing of potatoes and tobacco, two large New England crops. Even though considerable quantities of ammonium sulphate are produced here, the supply is not adequate for the demand and some has to be brought in from outside.

Glauber's salt was formerly in considerable demand by the textile industry but its use in this connection is decreasing and at the present time more Glauber's salt is produced than can be consumed in New England and some is sent out of this territory. The same is true of salt cake.

The New England production of aluminum sulphate (paper maker's alum) is more than sufficient to meet the local requirements and the surplus is shipped outside.

While considerable calcium carbonate is produced in New England it is as limestone and not in the finely divided form of Paris White or English Cliffstone. New England limestone is used in New England for the production of lime, pig iron, and portland cement.

Miscellaneous—While no sulphur is produced in New England, it can be delivered here at a low price by water transportation, making this district very favorably situated as regards this commodity. This is particularly true, of course, for those users who are located on tide-water.

Chlorine is made by electrolysis in this district and some is converted into hypochlorite for which there is an increasing demand.

Organic Chemicals—Of the organic acids, acetic is produced in limited quantities but not enough to meet the demand. Oxalic acid is not made. For the leather industry, which is prominent in this district, the tanning extracts used are brought in from outside, though a fair proportion of the oils used in softening and finishing the leather are prepared here. Much glue also is made in New England, both animal and fish glue.

The requirements of New England for denatured alcohol are only partially met by the production within her borders. On the other hand, the production of other organic solvents is more than enough for local needs and considerable quantities are sent elsewhere. The local market for these solvents is, however, increasing.

Of the various starches, New England produces only potato starch, but of this material produced in the United States, it is estimated that 80 to 85 per cent is made in the state of Maine. Casein is made in New England in limited quantities, not nearly sufficient to meet the local demands.

In the mind of the average person there may seem to be little connection between chemistry and economics, yet it is a truth which cannot be over emphasized that no problem in chemistry or chemical engineering is properly solved which does not take adequate consideration of the economic factors involved. Many a process which had a promising launching in the harbor of the laboratory has been wrecked on stern economic rocks when it reached the seas of the business world. It is essential therefore that any consideration of an industrial situation, even from the standpoint of chemistry, should consider, at least briefly, the outstanding points on the economic side.

New England probably has the most concentrated industrial activity of any group of states in the country. This means that it offers easy access to good markets. It has, for example, only 2.1 per cent of the area of the United States, yet 7 per cent of the population of the country lives here, 12.6 per cent of the capital investment of the country is invested here, 14.2 per cent of the industrial workers of the country work here and produce manufactured products with a value amounting to 11 per cent of the total for the United States. The density of population in this section is 119.4 per square mile as against 35.5 for the nation as a whole and the generally prosperous condition of these people is indicated by the fact that New England possesses 29 per cent of the savings banks deposits of the country, which is more than four times its proportion based on population or fourteen times based on area. Furthermore New England holds first place in production in the United States in thirty-six distinct lines of manufactured goods. New England offers a healthy market for a wide variety of commodities requiring chemicals for their production and it is likely to continue to do so for some time to come.

NEW ENGLAND is favored, so far as transportation is concerned, by her relatively long coast line. The statement is made in "A Railroad Policy for New England" Storrow Report, June, 1923, that "no other section of the coast line of the United States either on the Atlantic, the Gulf of Mexico or the Pacific contains an equal number of bays and arms of the sea affording such safe and easy access to deep water. More than 70 per cent of the New England population live and the major share of her industrial activity is carried on within fifty miles of the seaboard. Within this fifty-mile zone lives 97 per cent of the population of Connecticut, all of Rhode Island, 61 per cent of the people of Massachusetts, 57 per cent of New Hampshire and 77 per cent of Maine." This means that New York can be reached quickly and at the low rates of water transportation, while for goods destined for Baltimore, Norfolk, Jacksonville, and other southern ports, water routes take them around the congested rail centers of New York and Philadelphia and thus give quicker as well as cheaper delivery. Since the opening of the Panama

Canal, Boston (so far as freight rates are concerned) is nearer the Pacific Coast cities than is Detroit, Pittsburgh, Cleveland or Chicago.

If imported raw materials are required by a New England industry, the facilities of the port of Boston are available, facilities which have made it second only to New York in imports into this country. The same port offers equally good facilities for shipping manufactured products either to other parts of the United States or to foreign countries. It is 200 miles nearer Europe than New York is, 1204 miles nearer Panama and the west coast of South America than San Francisco is, and 117 miles nearer Rio de Janeiro and Buenos Aires than Baltimore is.

BOSTON is served by freight and passenger lines to the principal seaports of Europe and by regular freight lines to and from the Far East, South America, and Australia. In other words, New England possesses to an unusual degree the advantages of cheap water transportation for both export and import and in addition to her own active markets for manufactured goods, offers a ready access to those in foreign countries.

The port of Boston is also keeping pace with the developments in aviation and already has regular airplane connection with Hartford and New York. It is claimed that the airport at Boston is the most advantageously located of any on the Atlantic coast.

New England has long been an industrial district and for this reason it has the distinct advantage of having a good supply of skilled labor. Labor is available with experience in many different lines of activity, because of the wide diversity of the manufactures which are located here. This labor cannot be classed as cheap, but it is intelligent and skilled. Furthermore, the climatic conditions are such that labor in this section is relatively active by nature as compared with the somewhat lethargic temperament of labor in some other parts of the country. In other words, New England is a natural workshop and a great import center which offers as well unusual opportunities for the distribution of manufactured products.

NEW ENGLAND has sufficient power at reasonable rates to take care of all the manufacturing demands of the near future and ample power reserves to handle a very considerable expansion of manufacturing activity. At the present time it is linked in a huge power system which extends to Niagara Falls and beyond. In fact, as a "stunt" the street lights of one section of the city of Boston were illuminated one night a few months ago with electricity which was generated in Chicago. At the present time New England power is derived about equally from water power and steam. Its largest steam plant, which has an ultimate capacity of 400,000 hp. and which is on tide water, consumes less than one pound of coal for each kilowatt hour of electricity produced. This is well below the average for the country. There is still a very considerable amount of undeveloped water power in this region and if the experiment of generating power from the tides at Passamaquoddy Bay is successful, tremendous quantities of power would be available at a rate which might well attract large electrochemical industries to the state of Maine.

A striking example of the advantage to New England of having cheap water transportation has been afforded recently by the initiation of the production of pig iron at a tide water location within the limits of metropolitan Boston. The development is adjacent to a large gas and coke plant, and also not far from an oil refinery. The ore is brought by water from foreign countries, the limestone also by water from nearby Maine, and the coke is obtained from the adjacent coke plant. It has even been reported that some of the waste energy from the blast furnace is used for the production of steam for the oil refinery. The initial capacity of this plant is 500 tons of pig iron per day, which is about one-fifth of the requirements of New England industries. Plans are being made for materially increasing this production.

Although New England contains limestone in widely distributed localities, there is only one of these localities, so far as is known, which offers convenient access as well to the other raw materials necessary for the production of portland cement. Fortunately this location is near tide water in the state of Maine which means that fuel will be readily accessible at reasonable freight rates by the water route. A $3,000,000 portland cement plant is being erected at Thomaston, Maine, and it is expected that it will be ready to ship cement in 1928.

NEW ENGLAND would seem to be the logical center for a further expansion of the rayon industry than has as yet taken place there. The highest grade of wood pulp, suitable for rayon production, is made in New England and there is an ample supply of sulphuric acid and niter cake. New England is also convenient of access to ample supplies of caustic soda and carbon bisulphide. Perhaps as important as any other factor, New England has ample sources of relatively pure water. Its skilled labor should be readily adaptable to the rayon industry and finally, its large textile activities, particularly along the lines of the fine fabrics, offer a ready and convenient market for the finished product.

In addition to rayon, any industry requiring a highly purified wood pulp will find a source of high-grade raw material available in New England.

In general, it may be said that with the exception of timber and water, New England has little to offer in the way of raw materials. However, the concentrated manufacturing activity of the three southern New England states requires both directly and indirectly considerable quantities of chemical materials. Those which New England is adapted to produce are now in general being manufactured there. This means that for new industries requiring such materials, New England is in a favorable situation. Furthermore, New England offers the advantages of an ample supply of skilled labor and inexpensive freight rates by water both for bringing the necessary raw materials to the industries within her borders and for transporting the finished products to the ultimate consumer either in this country or abroad.

Preventing Oil Shale Coking

The formation of coke during retorting of "coking" oil shale can be prevented effectively by using noncoking shale in the retort charge, states the Bureau of Mines, Department of Commerce, which is conducting investigations on this subject. The fusing or coking property of a shale does not seem to bear any direct relationship to the yield or the quality of the oil produced from the shale, but lean shales rarely form troublesome cokes.

Industrial Opportunities in GEORGIA *Invite Many Chemical Developments*

By Andrew M. Fairlie
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THE SOUTH has long been awake to her industrial opportunities. On October 30, 1865, a son of the Old South wrote to a comrade:

> In order to develop the resources of your country you must let bygones be bygones and turn over a new leaf. Encourage immigration and home industry. Let the mechanic know that labor is honorable. He will pay you for the lumber that is now rotting in your forests. He will descend further into your mountains and bring forth the iron and coal that are lying there useless and will make use of your water power and establish large factories where now little grist mills are. I am convinced that our old institution (slavery) was the greatest drawback to the South, and that with its abolishment a new era has begun for us, and that in our apparent destruction, we will yet find our salvation and ultimate independence.

Much has been accomplished since 1865. The thrift and industry and general prosperity of the Southern population of today, in comparison with the despair and poverty left in the wake of Sherman's march, are forceful evidences of the achievements of sixty years of Southern enterprise.

The rapid development of the resources of a country in a large way requires the investment of large amounts of capital. Today capitalists are looking towards the South, to see what she has to offer. This article presents a brief survey of some of the undeveloped or partially developed resources of a great Southern State.

GEORGIA, with an area of 59,000 square miles, the largest State east of the Mississippi, is in size and resources "a nation in itself." In extent of territory Georgia is larger than England and Wales combined, larger than either Czechoslovakia, Austria or Greece, larger than any one of the six republics of Central America, and citations might be made of many other independent nations smaller in that area than is this state. Recognized as occupying an enviable position in its geographical location as in its possession of varied physical resources, Georgia is known as the Empire State of the South.

The resources of Georgia are as extensive and diversified as her territory is vast. They include, besides developed and undeveloped water-power, a wide variety of products derived from the animal, vegetable and mineral kingdoms.

The large potential water-power may be ascribed to the varied character of the topography of the State, and the diversity of minerals is accounted for by the diversity of the geological formations. Georgia lies in two of the major physiographic divisions of the United States, the Atlantic plain and the Appalachian region. There are parts of five physiographic provinces in Georgia, viz., the Coastal Plain, the Piedmont Upland, the Appalachian Mountain, the Appalachian Valley and the Appalachian Plateau. The Georgia parts of the Appalachian provinces have been given distinctive names of local significance, viz., Central Upland, Highland, Valley, and Lookout Plateau.

In 1923 Georgia was producing more than 25 different kinds of minerals in commercial quantities. The important minerals of Georgia include asbestos, barytes, bauxite, chlorite, chromite, clays, coal, feldspar, fluorspar, fullers earth, granite, graphite, limonite, hematite, limestones, manganese ores, marbles, marls, mica, ocher, pyrite, sericite, serpentine, slate, soapstone, talc and tripoli. The following table, published by the Geological Survey of Georgia, shows the value of the minerals and mineral products manufactured in the State in 1924:

Asbestos, coal and coke	$344,940
Barytes	574,208
Bauxite	101,770
Brick and tile	6,032,950
Clay	1,214,570
Fullers earth and manganese	1,193,374
Granite	1,438,281
Iron ore and ocher	485,128
Lime and limestone	507,098
Marble	2,651,217
Mica, talc and soapstone	34,242
Portland cement and slate	1,566,286
Sand and gravel	242,754
Total	$16,386,818

According to this table, the most important mineral products of Georgia in 1924, on the basis of total value

of the quantities produced, were brick and tile, marble, Portland cement, slate, granite, clay, fullers earth and manganese ores.

A VOLUME could be written on the ceramic resources of Georgia. In 1924 there were 100 brick, tile, sewer pipe, cement and clay-product manufacturers in the State, with a combined capital of $12,000,000, which used raw material valued at $3,800,000, employed 4,065 wage earners, and manufactured products valued at $8,865,000.

Most of these ceramic products were of the coarser grade—common brick and tile, sewer pipe, etc. The opportunities for the development of the high-grade ceramic resources of Georgia is just beginning to be recognized. The Canton Brick and Fire-proofing Co., an Ohio concern, has recently completed a half-million dollar plant at Gordon, Ga.—the Georgia White Brick Co.—for the manufacture of porcelain face-brick. This plant is said to be a direct result of the researches of the Georgia School of Ceramics, an enterprising department of the Georgia School of Technology. The white brick plant uses as raw material the feldspar and kaolin of central Georgia. Each brick is pierced by three holes an inch in diameter, thus reducing the weight, conserving material, and at the same time facilitating the drying process, without impairing the strength of the product.

The manufacture of other fine ceramic products in the South, such as table china, floor and wall porcelain tile, sanitary ware and refractories, is practically *nil.* Yet all the raw materials—flint, feldspar, ball clay, kaolin or china clay—abound in Georgia. It is a strange fact that the pottery centers of the United States, located in Ohio and New Jersey, obtain a large part of their raw materials from Georgia, North Carolina and Tennessee (but none from Ohio or New Jersey), ship $30,000,000 worth of fine chinaware and porcelain annually into the Southern states, and make it pay, yet no headway has been made towards the establishment of a large porcelain industry in the South, to take advantage of the lower labor cost and the reduced freight charges that would result from proximity of the plants to raw materials and markets.

With common labor in Georgia receiving but 20 to 40 cents per hour; with building brick at $11 to $14 per thousand; cement at $3 per barrel; crushed stone at $1.25 to $1.65 per ton; lumber at $24 to $60 per thousand feet; fuel oil, delivered Georgia points, at 6½ to 7¼ cents per gallon; coal at $3.50 to $4.50 per ton, with abundant hydroelectric power at low cost; with freight on raw materials negligible; and with freight rates to the markets of the South approximately 40 per cent lower than those of the pottery centers at East Liverpool and Trenton, apparent advantages of central or north Georgia as a site for a large chinaware and porcelain industry at least merit investigation.

The chief objection to the establishment of whiteware plants in this region is the alleged lack of skilled labor. Fortunately, this objection is easily surmountable. The bulk of the white labor of the South is of Anglo-Saxon stock, with only 2.1 per cent foreign born and only 6 per cent of foreign extraction. It is intelligent, and quick to learn new trades. Southern labor has learned to make pig iron and steel, to weave and spin cotton, to manufacture cement and cottonseed oil and a host of other commodities. It can certainly learn to make chinaware and porcelain. Alabama ranks as the fifth state in steel production; the South has 46 per cent of the cotton spindles of the country and 43 per cent of the looms; the South produces upwards of 20,000,000 barrels of portland cement a year. Southern labor can learn to make anything that is made in New Jersey or Ohio.

A well-balanced chemical, metallurgical and ceramic industry has been suggested for the Atlanta district. Byproduct coke-ovens, iron blast furnaces and ceramic kilns constitute the prominent features of the equipment required. The coke-ovens, operating on Georgia, Tennessee or Alabama coal, would yield, as primary products, coke to be used for smelting the iron ores of northwest Georgia, and gas for firing the ceramic kilns. The pig iron produced would undoubtedly be converted into steel. A large steel manufacturing company already established in Atlanta affords a local market for steel billets. As byproducts, the coke-ovens would yield ammonium sulphate and benzol, for the production of which the sulphuric acid of the Tennessee Copper Co., just north of the Georgia line, is available at attractive prices. The large fertilizer companies of Atlanta provide an outlet for the ammonium sulphate, and the ubiquitous filling station and its avaricious customer, the automobile, together constitute a bottomless abyss for the profitable disposal of the benzol. Sixteen million dish-breakers in eight southeastern states will furnish the market for the chinaware and porcelain.

Georgia Clays—The clay district of Georgia is shown on page 371 as a broad belt extending diagonally across the central part of the State. This belt, known as the Fall Line Hills, 220 miles long and from 40 to 50 miles wide, comprises an area of about 9,500 square miles, and it is within this area that the sedimentary kaolins and bauxites of industrial importance are found. An investigation to determine the value of the sedimentary clays of Georgia for the manufacture of whiteware was undertaken by a co-operative agreement between the U. S. Bureau of Mines and the Central of Georgia Railway. The findings of this investigation (Stull and Bole: U. S. Bureau of Mines, *Bull.* 252) were, briefly, as follows:

1. Considerable development of the Georgia clays has taken place, and many undeveloped deposits are available.
2. Georgia clays can be washed free from material that causes dark specks in white ware.
3. Georgia clays can be used to some extent in place of English china clay in floor and wall tile.
4. Georgia contains large deposits of refractory clays suitable for the manufacture of high grade refractories.
5. The service rendered by fire brick made from Georgia sedimentary kaolins was at least equal to and in most tests superior to that rendered by fire clay and aluminous brick.
6. Light-cream and light-grey face brick can be made from a mixture of Georgia koalin, aplite, and sand, comparing favorably with the best face brick of Pennsylvania.

The white clays of Georgia are useful also as fillers, principally in the manufacture of such commodities as kalsomine, matches, oilcloth, paint, paper, plaster and rubber. In 1923, the amount of domestic clays used as filler in various industries was 157,771 tons, of which 102,000 tons was used in the paper industry, 15,000 tons in the rubber industry, 13,000 tons in the manufacture of paints, and 8,000 tons in the manufacture of oilcloth. Many owners of Georgia clay deposits are not familiar with the requirements of the different industries for clays suitable for use as filler, and hence are unable to prepare their product for the most profitable market. The U. S. Bureau of Mines has determined by

a study of many samples of Georgia clays, the uses to which they are best adapted. Samples were taken from 31 deposits in 12 different districts of the Georgia clay belt, and after suitable preparation all but five of the samples were found to be suitable for filler in either the paper, the paint, the rubber or the oilcloth industry.

Georgia makes no oilcloth, and yet every one of the raw materials—cotton fabric, clay, barytes and linseed oil—is produced in Georgia.

Paint Materials—Besides clay filler, Georgia produces the following paint materials: ocher, whiting, barytes and its derivative lithopone, graphite, asbestos and linseed oil.

The ocher deposits are in the northwestern part of the State, near Cartersville. A large tonnage has been exported annually to England and Scotland. Upon calcination, the Cartersville ocher yields a red pigment of desirable shade. More than half the ocher produced in America comes from Georgia.

Barytes deposits also are found in the Cartersville district, as well as in Floyd, Cherokee, Gordon, Murray and Whitfield counties. Six companies are now engaged in the production of barytes in Bartow County.

At Hollywood, in Habersham County, an important asbestos mine is being worked. One of the products is 200-mesh asbestos, used in the manufacture of fireproof paints.

Graphite occurs in Cobb, Pickens and Bartow counties, but the only Georgian graphite district thus far worked is that near Emerson, in Bartow County. Besides paint, graphite is used for the manufacture of lubricants, pipe joint compounds, foundry facings, crucibles, and for electrotyping.

The production of turpentine and rosin in Georgia is well known, and will be referred to again below.

Linseed is not produced in Georgia, but at Elberton, Ga., not far from Augusta, linseed oil is produced at a factory operating on seed imported from Argentina. Georgia has an over-supply of cottonseed oil mills, which can of course crush linseed as well as cottonseed, and some of them can easily be spared for the production of all the linseed oil demanded by the paint trade of the South.

Portland cement—Portland cement is now produced at Rockmart and at Clinchfield. Limestone and shale suitable for the manufacture of portland cement occur also in Chattooga, Walker and Dade Counties, and the limestone and marbles of the Piedmont Plateau as well as the limestones and marls of the Coastal Plain are available for this purpose. White portland cement can be made in Georgia by combining the pure marble of north Georgia with white refractory clays. At present no white portland cement is made south of the Ohio and Potomac rivers.

Stone Mountain is useful as well as ornamental. Probably no granite in the South is more valued for building and paving purposes than that furnished by the quarries of Stone Mountain.

Marble—Of all Georgia's mineral resources, the one most fully developed is probably marble. Between Atlanta and the Tennessee line, a narrow strip of territory, paralleling a branch line of the Louisville and Nashville Railroad, and extending from Canton to Blue Ridge, a distance of sixty miles, contains the most valuable deposits of Georgia's marble. Out of this obscure region has come material for the building of many of the noblest and most costly structures of America—the Royal Bank of Canada, the State capitols of Rhode Island, Minnesota, Arkansas and Kentucky, the Corcoran Art Gallery in Washington, the Field Museum of Natural History in Chicago, and the New York Stock Exchange. It was on account of its uniformity of texture that Georgia marble was chosen for the statue of Abraham Lincoln in the Lincoln Memorial at Washington.

The center of the marble industry is Tate, a village about 40 miles south of the Tennessee line. Here a valley two and a half miles long and half a mile wide contains rich marble strata, the depth of which has never been determined. From the Tate quarries 800,000 cubic feet of marble are taken annually, and at this rate of extraction, according to estimates, the marble of this little valley alone would last 3,600 years. The abundance of the material has led to its use for purposes unheard of elsewhere. The mansion of the owner of the Tate quarries is built of beautiful pink marble; the cottages of the workmen in the quarries rest on marble piers; and even the main highway is surfaced with crushed marble.

The waste products of the great Georgia marble industry—marble dust, chips and waste slabs—await a satisfactory utilization.

Limestones and Dolomites—Both high-calcium and high-magnesium limestones are widely distributed in Georgia. The dolomites of the Cartersville district are a source of hydrated lime for the building trades. A subsidiary of the Coca Cola Co. manufactures in Atlanta, from Georgian dolomite and sulphuric acid from the Ducktown district of Tennessee, carbon dioxide which is shipped all over the southeast for use in the beverage industry, and epsom salts as a by-product. Insulating materials, with a base of magnesia, are not now made in the South. Georgian dolomites should become the basis of an industry producing insulating products, magnesite, and magnesian compounds.

Glass—The Coca Cola bottlers alone could support a glass factory. Add to their demands the requirements of the milk, patent medicine and drug trades, and the market for glass bottles must be obvious. Window glass is of course used everywhere. The raw materials, sand or quartzite, limestone are found abundantly in Georgia; soda ash is made in Virginia and should be made from the salt domes of Louisiana; salt cake can be made from niter cake—a waste product of many of the South's fertilizer plants. For fuel, either coal, oil, or gas from byproduct coke ovens may be used.

Chemicals—According to the U. S. Census, Georgia produced in 1923 only seven different kinds of chemicals. In 1926 Georgia consumed $16,000,000 worth of chemicals more than she produced. With vast deposits of bauxite and halloysite, she produces no aluminum metal, and as yet no salts of aluminum although an alum plant is now being planned for the vicinity of Atlanta. Growing a million and a half bales of cotton a year, and with soft water, cheap fuel and power, and an excess supply of female labor available, she manufactures no rayon, no pyroxylin, no viscose plastics of any kind. She buys and uses northern-made laundry soap, and throws her own oil and grease refuse into the sewer. She sends her cotton-seed oil to the North and buys it back as floating soap, filled with air-bubbles. Her textile and paper mills use large quantities of caustic soda,

but Georgia, with unlimited salt resources in the neighboring State of Louisiana, manufactures no sodium products. With a production of 1,200 tons daily of sulphuric acid within a half a mile of her northern border, no diversified chemical industry has been built up in north Georgia, for the utilization of this low-cost acid. Why not an oil refinery at Atlanta, for the refining of the oil that must be used in that district, and ship the crude oil to the acid and fullers earth, instead of hauling the refining materials long distances to the oil?

Lumber by-products—The products of the average yellow pine tree have been classified as follows: needles and twigs, 2.25 per cent; limbs smaller than 3 inches, 2.54 per cent; cord wood, 6.42 per cent; pulp wood, 4.54 per cent; red and rotten, 8.05 per cent; slabs and trimmings, 18.07 per cent; saw-dust and shavings, 17.02 per cent; lightwood, 0.61 per cent; stump, 6.48 per cent; lath, 1.39 per cent; shingles, 0.06 per cent; lumber and box shooks, 31.97 per cent.

From this analysis, it is evident that a large percentage of the tree is wasted, under the ordinary lumbering and mill procedure. But the long leaf yellow pine is now used extensively for the manufacture of kraft paper. In Georgia there are paper and pulp mills at Augusta, Gordon and Savannah, and there are similar mills in nearly every state in the South. This industry is destined to grow in Georgia, both because of the exhaustion of northern supplies of pulpwood and because in central Georgia natural reforestation takes place in from 15 to 20 years, yielding nearly two cords per acre perpetually, as compared with from 40 to 80 years for northern spruce, and an average yield per acre of only one-half cord per year.

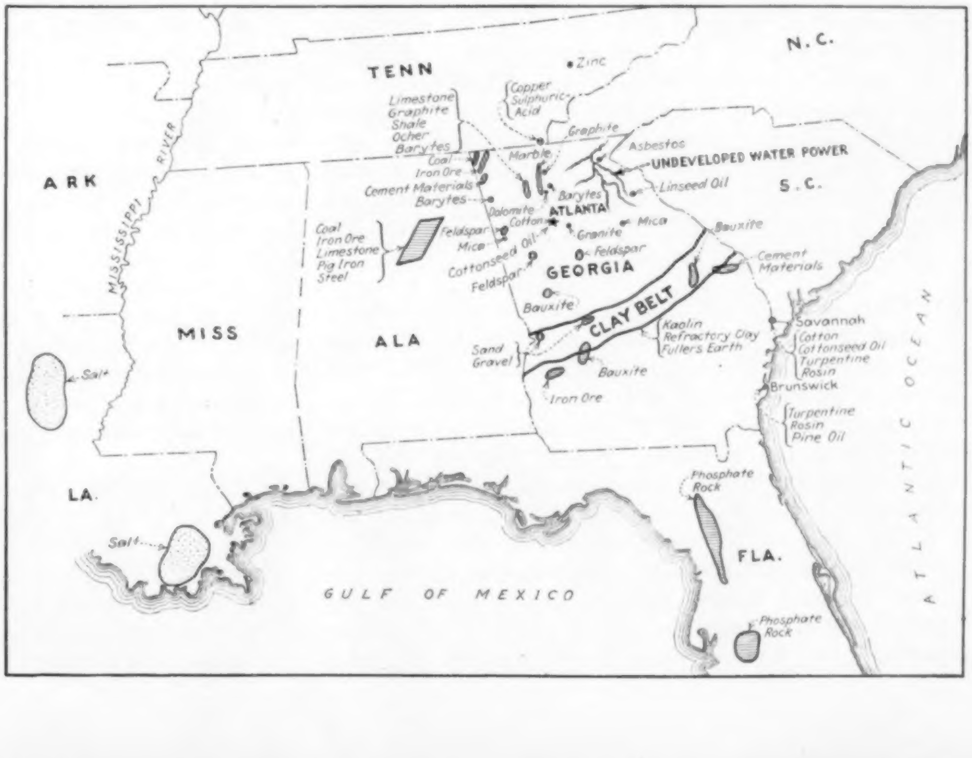
How yellow pine stumps may be utilized has been demonstrated by the large plant of the Hercules Powder Co., near Brunswick, Ga. Stumps that are eight or ten years old are blown out of the ground with dynamite, and at the plant are shredded to match-stick size. The splinters are cooked with steam at 400 deg. for 20 hours. The vaporized turpentine is condensed, and the rosin is dissolved out of the chips with gasoline, over 99 per cent of which is later recovered. The extracted chips are used as fuel. A ton of stumps is said to yield seven gallons of turpentine and four-fifths of a barrel of rosin. Pine oil for use in metallurgical flotation processes is a valuable byproduct. With progressive reforestation, the stump crop of Georgia will be a perpetual crop.

The ultimate development of a vast paper industry in the South is inevitable. It has been predicted that the production of lumber will ultimately become a mere incident to the business of lumbering. The chemical engineer, with his paper and pulp mills, his stump factories, his alcohol plants, his gas producers—all operating on those parts of the tree that were formerly thrown away—will create more wealth, as byproducts, than the lumberman with his axe and saw.

In 1924 Georgia had in operation 192 textile mills, 75 mills for the manufacture of awnings, mattresses and clothing, 29 cotton compresses, 60 cottonseed oil mills, 60 fertilizer plants, 100 brick, tile, sewer pipe and cement plants, 123 marble and granite quarries, 218 soft drink and bottling establishments, 137 electric power and light plants, 19 gas plants, 122 ice factories, 213 bakeries, confectioneries and ice cream manufactories, 101 barrel, box and stave factories, 22 broom, brush and mop factories, 58 canning plants, 162 flour, grist and feed mills, 173 furniture and finished woodwork factories, 68 laundries, and 23 leather plants and tanneries. Nearly all of these industries consume chemicals of some kind. This list, while incomplete will furnish some idea as to the magnitude and diversification of the industries now operating within the State. The total value of manufactured products in Georgia for the year 1924 was $445,000,000. With this figure before us, it is evident that the resources of Georgia are now being exploited to a considerable extent. In the manufacture of such commodities as ceramic-ware, paper, glass, cement, soap, refined oil, rayon, plastics, paints, and chemicals of all kinds, in proportion to her natural resources Georgia is weak, and awaits the captains of industry who will, sooner or later, bring about a better balance of industrial effort, based logically on resources and markets.

The accompanying map of Georgia and adjacent Southern States shows the location of some of the natural resources that yield raw materials for various chemical engineering industries. No attempt has been made to show in detail all of the similar resources of states other than Georgia.

In the compilation made for the January, 1927, issue of *Chemical & Metallurgical Engineering* it was shown that the State of Georgia affords an existing market for over $17,550,000 worth of chemicals per year while less than $1,000,000 worth are now being produced.



Chlorine Production a Key Industry

Methods used in manufacture and marketing of liquid chlorine, bleaching powder, and other chlorine products

By Robert T. Baldwin
Secretary, The Chlorine Institute, Inc.

CHIEF products of the North American chlorine industry are chlorine in the form of liquid chlorine and bleaching powder; other products are calcium hypochlorite, carbon tetrachloride, hydrochloric acid, hydrogen, mono- and dichlorbenzenes, sodium hydroxide and sodium hypochlorite.

Chlorine, the prime product, is nearly all produced by the electrolytic decomposition of aqueous solutions of sodium chloride, but there is a small byproduct tonnage derived from the electrolytic decomposition of fused sodium chloride in the production of metallic sodium.

The manufacture of chlorine is a very small part of the heavy chemical industry, and generally speaking the industry does not engage in elaborate manufacture of chlorine compounds or organic syntheses in which chlorine plays a part. Outside of the industry there are a small number of paper mills that make chlorine and caustic soda or soda ash for their own needs. At times these plants sell fused caustic soda or solutions of caustic soda, or sodium or calcium hypochlorite solution, and one paper mill liquefies chlorine gas, in excess of its own gas needs, for the market. There are also several sodium hypochlorite makers equipped with cells and a few small waterworks also make chlorine for their own needs.

Commercial liquid chlorine is a very pure product averaging over 99.75 per cent chlorine. This condition is due to three factors, viz.: (1) Care in manufacture; (2) physical difficulty in compressing an impure gas, and (3) the necessity of having a dry pure liquid if it is to be kept in steel containers. There are no general market specifications for liquid chlorine. The specifications of the Chemical Warfare Service can be satisfied by the ordinary commercial product. They set up no detailed requirements except that the liquid chlorine in any container shall average not less than 99.5 per cent of chlorine and the material shall be of a grade suitable for use in chemical manufacture. A special marking, however, is required when shipping on orders from the Chemical Warfare Service.

THERE is a serious misconception in the minds of many persons as to liquid chlorine consumption. Liquid chlorine is gradually replacing the chlorine content of bleaching powder and the consumption figures of liquid chlorine from year to year are therefore meaningless unless the bleaching powder figures and the total chlorine gas figures are available. Likewise any comparison of domestic and foreign statistics of the use of liquid chlorine is worthless unless the bleaching powder figures and the total chlorine gas figures are known. As said before, chlorine gas is produced not only by a chlorine industry, but by users of chlorine in paper mills, by sodium hypochlorite makers and by a few small waterworks. It follows therefore that no accurate consumption figures of chlorine gas, liquid chlorine and bleaching powder are available. The consumption, basis of chlorine gas, for all North America has been estimated as about 125,000 short tons in 1925.

The consumption of liquid chlorine in North America in 1926 has been estimated at about 65,000 tons. There is little seasonal variation due to the fact that the consumption is in fairly stable uses; about 50 per cent going to the paper industry; 15 per cent to the textile industries; 16 per cent to sanitation, and 19 per cent to all other uses. That is to say, three basic uses, paper, textiles, and sanitation take 81 per cent of the consumption. The "all other" uses include the manufacture of organic substances such as the chlorbenzenes, carbon tetrachloride, chloroform, amyl alcohols, ethylene glycol, benzoic acid, benzoate of soda; and inorganic substances such as aluminum chloride, hydrochloric acid and ferric chloride. Chlorine also has important uses in flour bleaching, in sweetening and bleaching petroleum, and in ridding the water side of condenser tubes of coatings and growths.

From the discovery of chlorine as an element in 1774 down to the present time, the uses have been restricted by the difficult physical and chemical nature of the substance, and, as has been said many times, until some substances other than rubber, glass, concrete and earthenware are available for apparatus that will reasonably withstand the corrosive action of wet chlorine gas and hydrochloric acid, large consumption in industry will not be had rapidly. An ideal use of chlorine in organic synthesis where chlorine is not in the end product requires the consumption of equivalent quantities of chlorine and caustic soda, and the return of the byproduct sodium chloride to the chlorine maker for the recurring cycle. Such ideal uses are far from being common. Where chlorine is a part of the end product, caustic soda generally does not have a use, but hydrochloric acid is most likely a byproduct. Byproduct hydrochloric acid cannot economically be resolved into hydrogen and chlorine. Hydrochloric acid, synthetic and non-synthetic, generally speaking, must compete in large technical uses with sulphuric acid, and does not, because sulphuric acid is much cheaper. The economics of hydrochloric acid are complicated and always have been, and are always a stumbling block in the path of the chlorine maker.

LIQUID chlorine in United States of America is shipped (1) in seamless steel cylinders of 10, 20, 100, 150 lb. capacity; (2) in forge welded steel containers of 2,000 lb. capacity, and (3) in forge welded steel tanks (Class V tank cars), of 30,000 lb. capacity. The container specifications are rigidly governed by (1) Interstate Commerce Commission Container Specifi-

cation No. 25; (2) No. 27; (3) No. 105. Canadian specifications are in conformity with these. This packaging requires a large capital outlay, and shippers keep complete record of every container, and maintain a rigorous inspection of every container prior to filling.

The small cylinders are shipped in carload and less than carload lots; the ton containers, fifteen to a special type of car, and handled as a tank car as to classification. The transportation in the United States of America of all three types is covered by "I. C. C. Regulations for the Transportation of Explosives and Other Dangerous Articles by Freight and Express and as Baggage, Bureau of Explosives, Pamphlet No. 9, Effective Jan. 1, 1923." The Canadian regulations are in conformity with these rules.

COMMERCIAL bleaching powder is sold with or without contract specification, and in several grades depending on the available chlorine content at time of shipment. Unless otherwise specified, commercial bleaching powder is sold on a basis of 35 per cent available chlorine at time of shipment. As it deteriorates slowly and loses strength while in the packages, it is often initially over 35 per cent available chlorine at time of shipment. In practice a little hydrated lime unchlorinated is added to each package to provide a stabilizing effect and absorb the uneasy chlorine that may be uncombined. It is one of the oldest chemical substances in commerce and has a continuous and interesting history since its first manufacture in England in 1799. Since the introduction of liquid chlorine in Germany in 1888 bleaching powder has steadily declined in use except in England, where the traditional uses of bleaching powder are still quite a factor.

There are no accurate figures on consumption in North America. Some paper mills making gaseous chlorine absorb the gas in hydrated lime and are thus bleaching powder manufacturers, and as before stated, at times sell calcium hypochlorite solution in relatively small quantities. In 1926 the American and Canadian production for sale was probably about 50,000 tons. Its uses parallel those of liquid chlorine. Except for small scale operations its use in the cotton textile industry has all but disappeared. Bleaching powder in quantity is not used in North America in organic synthesis. A large part of the 1926 production for sale was absorbed by the paper industry, exports took small quantities, and the remainder was consumed in calcium hypochlorite solution in many small technical uses.

The American and Canadian containers for both domestic and export use are sheet iron drums of 700-800 lb. capacity and small drums holding 100 and 300 lb. each, respectively. Wooden crated tins holding 10 lb. are supplied to small laundry operations. Considerable bleach is also packed for household use in pound tins.

Anything more than general statements on hypochlorites are impossible, because in the final analysis nearly all chlorine is used in the form of calcium or sodium hypochlorites. The statistics of specific amounts of the hypochlorites made by chlorine plants and others are not available, and even if had, the poundage or gallonage would be meaningless unless based on some strength criterion. "Ready made" sodium hypochlorite solutions are put up under many trade names and in various strengths of solution containing from 2 per cent to 16 per cent available chlorine depending on consumer's need. These solutions are strongly alkaline and aside from proprietary bottle packages are furnished in 5 and 14 U. S. gal. glass carboys in 14 U. S. gal. metal carboys rubber lined, 30 U. S. gal. steel rubber lined containers, 12,000 U. S. gal. glass or enamel lined tanks mounted on motor trucks. Calcium hypochlorite is furnished in steel tank cars of 8,000-12,000 gal. capacity, and in steel tanks of 1,200 gal. capacity, mounted on motor trucks. Both big and little tanks have an inside coating of bitumastic material to prevent corrosion of the steel. There are no special provisions governing railroad transportation. Imports and exports are nil. In the Tariff Act of 1922 calcium and sodium hypochlorites like liquid chlorine, are covered by Schedule 1, par. 5, at 25 per cent.

MONOCHLORBENZENE had a production of 8,687,-989 lb. in 1925 as reported by the U. S. Tariff Commission. Its principal use is as a dye intermediate. The technical grade is a colorless liquid with a boiling point at about 132 deg. C. It is handled in ordinary steel tank cars holding 8,000-12,000 U. S. gal., and in 300 lb., 500 lb., and 970 lb. steel drums. The imports and exports are nil. The Tariff Act of 1922 imposes an ad valorem duty of 40 per cent on the American selling price and 7c. per lb. specific duty.

Paradichlorbenzene had a production of 1,988,833 lb. in 1925 as reported by the U. S. Tariff Commission. Its principal use is as an insecticide for the peach borer. It also has a smaller use as a disinfectant. It is a crystalline substance, and the four technical grades, various sized crystals, are handled in 1, 10, 25, 50, 100, 150 and 300 lb. capacity wooden kegs and in galvanized steel drums with friction tops. The imports are nil and the exports negligible. The Tariff Act of 1922 imposes the same duty as on monochlorbenzene.

Orthodichlorbenzene is to date a byproduct, practically speaking, in the manufacture of paradichlorbenzene. So far only two uses of moment are being developed. It is apparently useful as a raw material in dyestuff manufacture and United States Government research in this matter is covered by an interesting paper entitled "The Preparation of Alizarin from Phthalic Anhydride and Orthodichlorobenzene" by Max Phillips in *Journal of the American Chemical Society*, 49, 473, 1927. It has also been found to be an insecticide for the psychoda fly common to trickling filters at sewage plants. The production figures for 1925 are not reported by the U. S. Tariff Commission. There is but one technical grade, a liquid containing from 5-25 per cent of paradichlorbenzene and a trace of metadichlorbenzene. It is handled in iron drums of 55 and 110 gal. capacity. Imports and exports are nil. Under the Tariff Act of 1922 the same duty as on monochlorbenzene is imposed.

The production of carbon tetrachloride was 16,163,-104 lb. in 1925 as reported by the U. S. Tariff Commission. It is principally used as a fire extinguisher liquid and as a solvent in dry cleaning. It is not flammable and is a non-conductor of electricity. Minor uses include industrial solvent, component of insecticides and a C. P. grade is used as an anthelmintic in the treatment of hookworm disease. The two technical grades are colorless liquids containing 95 per cent and upwards, and a grade testing about 99 per cent carbon tetrachloride. It is handled in ordinary steel tank cars containing 8,000-12,000 gal., and in 60, 120, 700, 1,400 lb. steel drums and in small tins of various sizes. The imports and exports are of no moment. The Tariff Act of 1922 imposes a duty of 2½c. per pound.

On the Engineer's Book Shelf

Thermodynamics and Chemistry

THERMODYNAMICS AND CHEMISTRY. By *F. H. MacDougall.* John Wiley & Sons, Inc., New York. 414 pp. Price $5.50.

Reviewed by George Granger Brown

MacDougall's Thermodynamics has been found a satisfactory text, particularly by physicists and physical chemists. The improvements in the second edition in those subjects concerning solutions and the third law bring the treatment up to date and should widen its use in these fields.

MacDougall has followed Planck's method of treatment in the main, with Gibbs' development of the phase rule. The book is more easily read than either Gibbs or Planck, and serves the student as an excellent introduction to the whole field of physical and chemical thermodynamics.

The expressed purpose of writing, "A book which in addition to being accurate, logical and sufficiently rigorous will furnish the student with numerous examples of the application of the principles of the science", seems to have been attained with a high degree of success. The book is accurate, particularly regarding the thermodynamic potentials or free energies, and their relation to the maximum work obtainable from a process; the decrease in the "thermodynamic potential (Φ)", identical with Lewis and Randall's "free energy (F)", is correctly stated (p. 111) equal to the maximum work *minus the purely mechanical (expansion) work* in a process at constant temperature and pressure. The third law is well handled. The relations between Gibbs' chemical potential "μ" and Lewis' activity are well presented. The treatment is logical and clear. In only one respect the treatment appears to lack clearness. The limitations to equations derived upon assumption of the ideal gas laws are frequently not indicated.

Although some numerical relations are developed in the text, as the equilibrium constants in Chapter XV, the "numerous examples of the application of the principles of the science" are confined largely to an adequate assortment of problems at the end of each chapter. Generally numerical relations are necessary to practical applications of principles. In emphasizing the derivation of some 767 algebraic formulas which appear frequently to be regarded in the text as the final product, and leaving practically all the applications to unsolved problems, the treatment seems to be developed from the point of view of a mathematical physicist. The lack of numerical application is particularly evident in the treatment of the phase rule. The quantitive relations of the phase rule are algebraically developed in Chapters XI and XIII. The parts of Chapters XII and XIV dealing with definite systems are purely descriptive, void of any quantitive relations. This is unfortunate in a book written for chemists, as the real value and satisfaction in thermodynamics to a chemist or engineer is not in deriving formulas which "may be applied," but in applying the principles of the science to the quantitive numerical solution of daily problems. Adequate problems have been included which can be used by a skillful instructor to emphasize the application of thermodynamic principles, but the practical value of the book could be greatly increased if the relations were more frequently expressed numerically.

The frequent use of "now" as a conjunctive adverb is unnecessary and becomes annoying in some sections. One wonders why the correction of mistakes in the first edition ceased with p. 18.

The book is complete, modern, free from error, well supplied with problems and should be carefully considered as a possible text by teachers of thermodynamics, particularly physicists and physical chemists.

The Chemistry of Dyeing

THE CHEMISTRY OF DYEING. By *John K. Wood,* lecturer in physical chemistry, College of Technology, Manchester. Gurney & Jackson, London. 104 pp. Price 3s. 6d.

During the thirteen years that has elapsed since the first edition of this little book, considerable advance has been recorded in the chemistry of dyeing processes. This, the second edition, embodies the gist of new developments, and in other particulars it has been brought up to date. The important topics of discussion are: the chemical composition and properties of the textile fibers; mercerization; hydrolysis of wool; artificial silks; classification of dyes; the use of assistants; dialysis of dye solutions; molecular complexity of dyestuffs; conductivity of dye solutions; osmotic pressure measurements; membrane hydrolysis; theories of dyeing, with especial reference to the chemical theory; adsorption; and mordant dyeing. A brief working bibliography is appended.

Properties of Inorganic Substances

PROPERTIES OF INORGANIC SUBSTANCES. By *Wilhelm Segerblom,* instructor in chemistry at the Phillips Exeter Academy. The Chemical Catalog Company, Inc., New York. 226 pp. Price $6.

Segerblom's book on the properties of inorganic substances, which has been used by chemists since 1909, now appears in a second revision and enlargement. The current edition not only brings the numerical data up-to-date, but includes properties of about 750 substances not treated in the earlier editions. Among the new substances are the carbides, hydrides, and hypochlorites of the members of the six groups of bases, and the bromides, carbonates, chlorides, hydroxides, nitrates, sulphates and sulphides of the non-metals and rare metals. The common and trade names of about 600 substances have been added to the previous lists. The usefulness of the solubility data have been increased by the inclusion under the solubility of water of the number of grams of the substance soluble in 100 gm. of water at 0 deg. C., at ordinary temperature and at 100 deg. C.

The Chemistry of Power Plants

THE CHEMISTRY OF POWER PLANT. By *W. M. Miles*, F.C.S., A.I.Mech.E. Ernest Benn Ltd., London. 144 pp. Price 6s.

"The Chemistry of Power Plant" is a member of the *Chemical Engineering Library*, many volumes of which already have been reviewed in these columns. The book has as an objective the brief description of the analyses and tests necessary for the various materials used in the power house and to summarize some of the more important problems that from time to time require solution. Principal among the subjects discussed are: coal analysis, combustion and valuation, including the sampling of coal, determination of volatile matter and determination of calorific value; gas analysis; calculation of combustion losses; calculation of heat balances; specifications for the purchase of coal and evaporation tests; water softening; properties, analysis and selection of refractory materials, and discussion of transformer and switch insulating oils. Power plant engineers and chemical engineers that have an interest in the efficient generation of power and process steam should find this book an immense help. It sets forth the technique essential to accurate data and in addition furnishes guidance in the interpretation of these data.

Calculations of Quantitative Chemical Analysis

CALCULATIONS OF QUANTITATIVE CHEMICAL ANALYSIS. By *Leicester F. Hamilton*, associate professor of analytical chemistry, Massachusetts Institute of Technology and Stephen G. Simpson, instructor in analytical chemistry, Massachusetts Institute of Technology. McGraw-Hill Book Company, Inc., New York. 239 pp. Price $2.25.

With the exception of certain additions and changes, this second edition remains unchanged. Chapters and problems on electrometric titrations and on equilibrium constants have been inserted. The choice of problems and illustrative examples has been widened, and the descriptive matter on the precision of measurements, calibration of weights, electrolysis and indicators has been expanded.

Catalysis in Theory and Practice

Catalysis in Theory and Practice. By Eric K. Rideal and Hugh S. Taylor. Macmillan & Co., Ltd., London. 516 pp.

Reviewed by E. D. Ries

The new edition of this work is most welcome to those interested in catalysis. So much new data and so many new theories have been brought out since the first edition in 1919 that it is almost impossible to keep abreast of developments. The authors have therefore done a great service in adding the newer knowledge to their book. In revising their work, they have wisely refrained from attempting to make it a complete reference volume and have emphasized only the methods of attack and the outstanding experiments of each branch of the subject.

A noticeable improvement is seen in the expansion of the general theory and the introduction of mathematical exactness wherever possible in Chapters II to IV. Chapters V and VI on promoters, mixed catalysts, poisons, etc., are well worth the added space given them. Two subjects, however, have been rather briefly treated. The material on ferments and enzymes has been considerably condensed compared to the first edition, and the new high-pressure syntheses could profitably have been treated at greater length.

Although the total number of pages is only slightly more than in the first edition, the size of type has been reduced and there is more material per page. On the whole, there is a great improvement over the first edition and the book is to be highly recommended.

Three Books for the Paint, Varnish and Lacquer Industry

VOLATILE SOLVENTS AND THINNERS. By *Nöel Heaton*. D. Van Nostrand Company, New York. 158 pp. Price $4.50.

Reviewed by W. T. Pearce

The author defines a volatile solvent "as an organic liquid which can be distilled without decomposition, which is capable of complete evaporation at atmospheric temperatures and which has a pronounced solvent action in oils, fats, waxes and similar substances without altering their chemical composition." The substances are classified as: petroleum hydrocarbons, coal-tar hydrocarbons, the turpentine group, the alcohol group, ketones and ethers, esters, hydrocarbon chlorides and sulphur derivatives. More than sixty solvents are discussed.

The author has carefully reviewed the literature and a complete list of references is given at the close of each chapter. The arrangement of material could be improved in many cases, and some of the discussions improved as well as shortened, by referring the reader to a text-book upon organic chemistry for some of the material included.

This book is recommended to paint and varnish technologists, especially those primarily interested in nitrocellulose lacquers.

THE CHEMISTRY OF THE NATURAL AND SYNTHETIC RESINS. By *T. Hedley Barry, Alan A. Drummond* and *R. S. Morrell*. D. Van Nostrand Company, New York. 196 pp. Price $5.50.

Reviewed by W. T. Pearce

The first half of the book is devoted to a discussion of the natural resins. This includes chapters discussing physical and chemical properties of resins and a discussion of hard, semi-hard, spirit varnish and soft resins. The inclusion of the botanical origin and formation of the resins adds much to the interest of the book. A good discussion of the chemical composition and constants, the methods of examination, and methods of production are found. Excellent discussions of turpentine and rosin, and of shellac are contained in two chapters which alone would justify the publication of the book.

The last half of the book contains the following chapter headings: formaldehyde-phenolic resin, causes of resinification, hardened rosin, coumarone, indene and acrolein resins, other aldehyde resins, and methods of testing synthetic resins. A very instructive discussion is given of the formation of phenolic resins and of the causes of resinification. Valuable information concerning lime hardened rosin, ester gum, and oil soluble phenol-formaldehyde and urea resins is contained in the closing chapters.

The authors are specially to be commended for their careful survey of the literature dealing with synthetic resins, and for securing much recent information concerning them. The reviewer believes all paint and varnish technologists will find this book of unusual interest and value.

THE ANALYSIS OF PIGMENTS, PAINTS AND VARNISHES. By *J. J. Fox* and *T. H. Bowles*. D. Van Nostrand Company, New York. 179 pp. Price $4.50.

Reviewed by W. T. Pearce

Six chapters are devoted to the chemical analysis of pigments. It is unfortunate that the authors decided to omit all physical tests, which are of such tremendous importance in evaluating a pigment. The methods given for the analysis of white pigments are satisfactory so far as they go; methods for calcium carbonate, asbestine and barites being omitted. No method for added coloring matter (organic) is included for the examination of colored mineral pigments. In Chapter VII, which is devoted to the analysis of mixed paints, no scheme is given for the analysis of the separated pigments. This diminishes the value of the book for the less experienced analyst.

The examination of varnishes is discussed in twenty-two pages. The method given for determining viscosity is unnecessarily long and complicated. One would expect to find either the Gardner-Holdt or McMichael methods presented. One is also surprised to find water resistance not discussed, for without this test, a correct evaluation of any exterior or floor varnish is impossible. The determination of the acid value is also omitted.

In spite of these criticisms, this book will be of considerable service to analysts interested in pigments, paints and varnishes. It is well arranged and contains the methods found reliable by the authors. The description and explanation of the many procedures are so clear that one finds little difficulty in following them.

Monograph on Chemical Industry

A comprehensive memorandum on the Chemical Industry has been issued as part of the documentation of the International Economic Conference, which began its sessions at Geneva on May 4. The document was prepared by the Economic and Financial Section of the League of Nations from information furnished to it by governments, by members of the Preparatory Committee for the Conference and by industrial organizations, which prepared memoranda at the request of members of the committee.

The salient phases of the subject and its international aspects are examined from this mass of information, and the statistical tables and summaries, as a consequence, are the most comprehensive, authentic and up-to-date available.

The memorandum is obtainable from the American agent for publications of the League of Nations, World Peace Foundation, 40 Mt. Vernon Street, Boston, Massachusetts. Price $1.00.

Pauling Patent for Concentrating Nitric Acid Validated by Court of Appeals

In declaring the Pauling patent No. 1,031,864 for the recovery and concentration of waste nitric acid valid, the U. S. Circuit Court of Appeals for the Third Circuit reversed the devision handed down by Judge Bodine in 1925 in the U. S. District Court for the District of New Jersey (see digest in *Chem. & Met.*, vol. 32, p. 816). As a result of this decision, the appellee, the E. I. duPont de Nemours & Co., Inc., has been ordered to account to the Southern Electro-Chemical Co., appellant.

It will be recalled that the Pauling process consists in passing a mixture of aqueous nitric acid and sulphuric acid in countercurrent to an upward flow of steam in a vertical column or tower suitably packed. The flow of steam is so regulated that concentrated nitric acid vapors leave the top of the column while the sulphuric acid carrying substantially all the water originally in the spent acid flows from the bottom of the column. The plaintiff contended that the duPont company infringed the Pauling patent at one of its plants in Delaware, and the defence to this contention was that the Pauling process was anticipated in the prior art because it is the same as occurs when a steam-heated denitrating tower is efficiently operated without excess of steam; that such a tower when efficiently denitrating spent mixed acid from explosives manufacture performed essentially the same process as that of the Pauling process.

In its opinion, the higher court says: "Does Pauling's patent involve invention? As against invention it was contended that the change was slight, that it was merely the substitution in a high tower of a steam counter current instead of an air or gas counter current. Physically, that is the fact, but when results are looked at which this slight change has brought about in its art, we put behind the word slight, and find fitting expression in such words as unlooked for, revolutionary and the like. * * * In the nature of things, we cannot define just what makes Pauling's or any other process inventive, but when a great art has been for a long time and with blind eyes traveling along a line, and some practical man as here raises his eyes, sees there is a boundary line between prosaic old practice and possible prospective improved practice and crosses such line by a few short steps and passes into a new and more productive field, assuredly the shortness and simplicity of his step should not belittle the change it has brought about. * * * As Pauling uses no heat-girdling encircling furnace outside his tower, and no hot air or other gas within his tower, it is clear he could not infringe the method disclosed by Sohlman and Wilson for use of their claim-specified elements, and if we are right in saying Pauling did not infringe Sohlman's patent, how can we say that Sohlman and Wilson with their air or gas counter current anticipated what they neither disclosed or claimed, to wit, a steam counter current. If they found, as they did, the steam counter current in the old art and discarded it and claimed and got their patent because of their substitution of air or gas as a counter current agency, why should not the difference between steam and air or gas which served to get them one patent, serve to equally differentiate from their air and gas process another patent which clung to the use of steam? Evidently the Patent Office, where the two processes were being contemporaneously considered, so regarded the matter.

At the close of his dissenting opinion, Judge Woolley says: "Did Pauling make an invention in taking the one-quarter step from Sohlman's long counter current of heated air as a vaporous heating medium to an equally long counter current of mixed heated air and steam as a vaporous heating medium; or in taking the one-half step from Sohlman's long counter current of heated air to an equally long counter current of dry steam; or in taking the three-quarter step from Sohlman's long counter current of heated air to an equally long counter current of steam, preferably superheated? I think he did not. For this reason I would hold the patent invalid. I am therefore constrained to dissent from the judgment of the court."

Selections from Recent Literature

Corrosion. The effect of certain impurities in zinc upon its corrosion in acid and oxygenated solutions. W. S. Paterson, *Chem. & Ind.*, vol. 45, pp. 325-30T.

Bleaching Oils. B. Neumann and S. Kober. *Zeitschrift für angewandte Chemie*, March 24, pp. 337-49. A comparison, illustrated with curves and tables, of the bleaching properties of clays and fuller's earths from various sources, floridin, kaolin, lunite and the like. Adsorption experiments were made with soy bean oil and with a dye solution in paraffin oil. The theory that bleaching of oils is a purely physical (adsorption) process agrees with evidence; but the theory does not suffice to explain all the pecularities of adsorbents.

Antimonial Frits. H. Haupt and G. Popp. *Zeitschrift für angewandte Chemie*, Feb. 24, pp. 218-21. The use of Timonox in glazed and enamel ware for food purposes is unsafe and should be forbidden because such ware gives up $Sb^{\cdot\cdot\cdot}$ to food cooked in it. Leuconin frits, on the other hand, are safe, because they give up practically no $Sb^{\cdot\cdot\cdot}$ and not very much $Sb^{\cdot\cdot\cdot\cdot\cdot}$ when boiled with weak organic acids. Tartaric acid, which dissolves out more Sb than any other food acid, is not common in foods to be cooked.

Ammonia from Lignite. K. A. Hoffmann and H. Groll. *Zeitschrift für angewandte Chemie*, March 10, pp. 282-7. In making H_2 from coke and steam, ordinary coke is not active enough at 500 deg. C., at which temperature the reaction: $C + 2H_2O = CO_2 + 2H_2$ greatly predominates over the less efficient reaction: $C + H_2O = CO + H_2$. This difficulty has been overcome by a special procedure for carbonizing lignite; a highly active coke is obtained. With the aid of catalysts (Mn and Co) the nascent H_2 is made to hydrogenate the coke, with formation of NH_3 (all the residual N is converted to NH_3) and hydrocarbons.

Potash Preheater Corrosion. Gerhart Jander and Hans Banthien. *Zeitschrift für angewandte Chemie*, March 10, pp. 287-8. Corrosion of Cu preheaters in a potash works was traced to presence of $Fe^{\cdot\cdot\cdot}$ in the liquor. The difficulty was overcome by passing the liquor, before entry into the preheater, over a reducing agent such as Fe or Cu turnings to reduce $Fe^{\cdot\cdot\cdot}$ to $Fe^{\cdot\cdot}$.

Canadian Chemistry. A ten-year review, with articles on research in the Canadian universities; progress of mining and metallurgy in the provinces; statistics, and national research. Illustrated. *Canadian Chemistry and Metallurgy* (Tenth Anniversary Number), May, pp. 105-36.

Cellulose Research. J. Scheiber. *Farbe und Lack*, April 20, pp. 190-2. A review of recent advances in the chemistry of the cellulose esters, and their uses in plastics and coatings. Illustrated with photomicrographs.

Malt Extracts. Josef Weichherz. *Chemiker-Zeitung*, April 13, pp. 273-4; April 20, pp. 291-2. In malt extract evaporators, particularly those with heating jackets or coils, there is a critical concentration beyond which the efficiency falls off rapidly. Temperature charts are shown to illustrate the operation of evaporators.

Colloidal Molybdenum. E. Wedekind and O. Jochem. *Zeitschrift für angewandte Chemie*, April 14, pp. 434-8. The calcium process, previously used for making Zr metal, was applied to the manufacture of dense and colloidal preparations of Mo. The colloidal metal can be pressed into rods. The properties of a hydrosol of Mo are described.

Active Silica. Otto Ruff and Paul Mautner. *Zeitschrift für angewandte Chemie*, April 14, pp. 428-34. A comparison of the adsorption properties of silica gel (various preparations) and other active forms of silica, including kieselguhr, tabasheer. Uses of active silica as a catalyst, in petroleum refining and for purifying gases are discussed. Numerous literature references are cited.

Pickling Steel. W. Henry Ibbotson. *Industrial Chemist*, April, pp. 147-8. Relative merits of H_2SO_4 and HCl: suitable conditions for pickling; merits and demerits of proprietary "pickle aids."

Synthetic Perfumes. Percy May. *Industrial Chemist*, April, pp. 158-61. A brief review on the various compounds used in making artificial perfumes and flavors. Vanillin, coumarin, saccharin and artificial musks are included.

Casting Metals. W. Meysahn. *Chemiker-Zeitung*, April 27, pp. 309-10. Brief instructions in making castings of brass and bronze, with particular reference to repairing of chemical apparatus and equipment.

Essential Oils. Konrad Bournot. *Zeitschrift fur angewandte Chemie*, April 28, pp. 477-86; May 5, pp. 507-12; May 12, pp. 533-8. A review, with many literature citations, of advances made in the chemistry and technology of essential oils and terpenes in 1924-1925.

Polysaccharide Gels. L. Zakarias. *Chemiker-Zeitung*, April 30, pp. 321-2. Stabilized gels of the vegetable mucilages have been prepared, using such preservatives as $MgCl_2$ and $CaCl_2$. These gels have excellent properties for use in ointments, emollients, cosmetics and the like. They will probably also find commercial application in lubricants, polishing pastes and the like.

Cork Researches. Fritz Zetzsche and G. Rosenthal. *Helvetica Chimica Acta*, May, pp. 346-74. A detailed study of the chemical nature of cork, its peculiar elastic properties and its behavior toward chemical reagents. The water-soluble portion of raw cork, and the portions soluble in various organic solvents, were examined separately. The effects of acids, alkalies, oxidizing and esterifying agents were studied.

Anti-Knock Agents. Chas. Moureu, Chas. Dufraisse and R. Chaux. *Chimie et Industrie*, April, pp. 531-5. Theories of the mechanism of anti-detonant effect are compared and discussed. Experimental evidence indicates that the effect is essentially an anti-oxidant action. Hence the conclusion is drawn that anti-knock agents function simply by negative catalysis; that is, they retard the attack of oxygen on the fuel.

Active Carbon and Phosphorus. Edouard Urbain. *Chimie et Industrie*, April, pp. 536-40. In the manufacture of active carbon by heating peat or the like with phosphoric acid, P and CO are obtained as by-products. The phosphoric acid for the process is made by heating raw phosphate, sand and coal. The other products are cement, H_2 and CO (nearly pure if the electric furnace is used). Large amounts of H_2 are produced by catalytic oxidation of the by-product P and CO with steam under pressure. The correlation of these processes on a commercial scale is described.

Toniolo-Nitrum Process. C. Toniolo. *Chimie et Industrie*, April, pp. 546-53. The physico-chemical principles governing the efficient production of nitric acid from ammonia are discussed in detail. If these principles were faithfully applied, great savings in capital investment and production costs could be made as compared with present prevailing practice.

Manganese Driers. Felix Hebler. *Farbe und Lack*, May 4, pp. 258-60. Compounds of Mn (including natural and precipitated manganite, artificial and Java pyrolusite and Mn borate) are useful and effective drying agents in paints and varnishes. Their loss of reputation in the trade has been due to misrepresentation and gross adulteration.

Blood Plastics. K. J. Breuer. *Kunststoffe*, May, pp. 102-3. The plastics derived from blood have hitherto had the disadvantage of being available only in their natural color, black. Chemical bleaching has not been successful; but it has now been found that a light color can be imparted by precipitating Pb chloride on the material before it is polished. A wide color range can then be obtained by proper use of dyes. Penetration is sufficient so that the color does not rub nor wear off; it lasts for the life of the article.

Paint Driers. Claude E. Watson. *Journal of the Society of Chemical Industry*, May 13, pp. 436-8; May 20, pp. 457-9. Driers are of three classes: raw materials (such as the lead driers) which are mixed with the oil directly; chemical products, such as the salts of fatty or resin acids; and the liquid driers, japan driers and the like. In the main, the effective substances are oil-soluble compounds of metals having more than one stage of oxide valence. They form colloidal solutions in drying oils, and appear to function by peroxide formation. Various uses of driers are discussed.

Wool By-Products. E. R. Trotman. *Industrial Chemist*, May, pp. 195-6. The commercially valuable substances recovered from raw wool are wool fat and suint. The fat yields lanolin, wool stearin and fatty acids which can be used in soap making, or can be neutralized with lime and distilled to obtain mixed ketones. Suint is recovered

chiefly for its potash content. It is probable that other uses will be found for both products.

Hydrogenation. E. J. Lush. *Industrial Chemist*, May, pp. 197-200. A review of patents and literature covering the catalytic reduction of unsaturated fats and oils.

Dyeing Rayon. R. G. Foulds. *Industrial Chemist*, May, pp. 205-7. Problems and methods in the application of direct and developed colors and the sulphur, vat and basic dyes to artificial silks of the regenerated cellulose type.

Sulphuric Acid. Arthur Grounds. *Industrial Chemist*, May, pp. 208-12. Illustrated description of the functions and use of the Schmiedel box as a unit in the manufacture of H_2SO_4 by the lead chamber process. A flow sheet is shown for a plant using 3 Schmiedel boxes. The best arrangement is to effect a "preparatory" reaction in a Schmiedel box and to provide another unit, preferably a tower, for the final conversion; but some plants have boxes and chambers or boxes and towers and chambers. Plants with boxes only (no towers or chambers) have not been very successful.

Submerged Flame. Oscar Brunler. *Industrial Chemist*, May, pp. 214-9. Illustrated description of the industrial applications of the Brunler internal combustion boiler. Principal uses are in concentrating sulphite liquor, $ZnCl_2$ solutions, sewage, etc.; in making nitrates from air; in melting minerals and slag, and like uses. A short sketch of the origin and construction of the internal combustion boiler is given.

Liquefied Coal. J. G. King. *Journal of the Society of Chemical Industry*, May 20, pp. 181-6T. A report of experiments at the Fuel Research Station on production of motor spirit and fuel oils by distilling and cracking tar, and on the synthesis of liquid fuels by catalytic hydrogenation of coal and of CO. The difficulties of berginization are being studied in the Station's medium-scale plant. There are many problems which must be solved for commercial success, but progress is being made.

Tar Acid Recovery. D. W. Parkes. *Journal of the Society of Chemical Industry*, May 20, pp. 186-93T. Advantage has been taken, on a commercial scale, of the fact that activated carbon removes phenols from quite dilute aqueous solutions; a continuous apparatus has been devised for recovery of phenols from ammonium sulphate still effluents. Practical success depends on use of a high grade carbon; otherwise the carbon requirement is too high or else the flow of liquor is too slow. The apparatus and its use are described and illustrated.

Fluoride in Enamels. G. Agde and H. F. Krause. *Zeitschrift fur angewandte Chemie*, May 12, pp. 525-33. Microscopic studies were made to determine the behavior of fluorspar, cryolite and artificial fluorides in glasses and enamels, and their suitability with respect to their two functions of opacifying and improving the physical properties of glass. A theoretical reason was found for the after heat treatment which has been adopted empirically for enamel ware. Illustrated with photomicrographs.

Sulphuric Acid. Heinrich Molitor. *Chemiker-Zeitung*, May 4, pp. 329-32; May 18, pp. 370-3. A review of methods for producing H_2SO_4 from $CaSO_4$. The processes of Bambach, Bayer, Basset, Emming and Lake, Cantilena, Prior, Badische Co., Claus Schwefel Co. and others are discussed

Haveg. Johann K. Wirth. *Chemiker-Zeitung*, May 11, pp. 349-51. Illustrated account of recent advances in the construction of acid resisting chemical plant equipment from Haveg alone, or with iron, stoneware and other materials. A Haveg cement is also in successful use. Bakelite is used in making Haveg.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for issue.

Subject Index of U. S. Tariff Commission Publications, revised to December, 1926. A United States Tariff Commission pamphlet. 10 cents.

Iron in Pigs—Report of the U. S. Tariff Commission to the President of the United States, with Appendix Proclamation by the President. 10 cents.

Barium Carbonate — Preliminary statement of information obtained in the pending investigation, as ascertained pursuant to the provisions of Section 315, Title III of the Tariff Act of 1922. U. S. Tariff Commission mimeographed statement.

The German Aluminum Industry, (Part two) by Consul H. C. Claiborne, Germany. Special Circular 569 of the Minerals Section, Bureau of Foreign and Domestic Commerce. (Mimeographed). Part one was Special Circular 520.

Possibilities for Para Rubber Production in Northern Tropical America, by John C. Treadwell, C. Reed Hill, and H. H. Bennett. Bureau of Foreign and Domestic Commerce Trade Promotion Series No. 40. 65 cents.

British Chemical Trade, by Homer S. Fox. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 465. 10 cents.

Sources and Distribution of Major Petroleum Products Atlantic Coast States—1925, by E. B. Swanson. Bureau of Mines Circular 6031.

Petroleum Refineries in the United States, Jan. 1, 1927, by G. R. Hopkins. Bureau of Mines directory of the industry.

The Use of Flocculating Reagents for the Recovery of Fine Mica, by W. M. Myers. Bureau of Mines Serial 2798.

Problems in the Firing of Refractories, by G. A. Bole, John Blizard, W. E. Rice, E. P. Ogden and R. A. Sherman. Bureau of Mines Bulletin 271. 50 cents.

Standards' Yearbook, 1927. The first of a series of annual volumes of the Bureau of Standards discussing American and international trends and agencies in work on standardization. Bureau of Standards Miscellaneous Publication No. 77. Cloth binding. $1.00.

Magnetic Reluctivity Relationship, by Raymond L. Sanford, Bureau of Standards Scientific Paper 546. 5 cents.

The Lovibond Color System — A Spectrophotometric Analysis of the Lovibond Glasses, by K. S. Gibson and F. K. Harris. Bureau of Standards Scientific Paper 547. 15 cents.

U. S. Government Master Specifications on the following materials issued under Bureau of Standards Circular Numbers indicated: Cement, Masonry, No. 321; Integral Waterproofing Material, Water-Repellent Type (for use with Portland Cement Mortar or Concrete) No. 322; Calcium Carbide Spec. No. 470 (not yet in circular form). 5 cents each.

Mineral Production Statistics for 1926 — Preliminary mimeographed statements from Bureau of Mines on: Natural Sodium Compounds and Borates; Refined Primary Lead; Salt; Potash; Mercury; Slab Zinc and Rolled Zinc; Masonry, Natural, and Puzzolan Cements; Lead and Zinc Pigments and Zinc Salts; Platinum and Allied Metals.

Production Statistics from 1925 Census of Manufactures in preliminary mimeographed form for: Pyroxylin Solutions and Plastics, and Other Plastics; Bleaching Compounds; Gas, Manufactured, Illuminating and Heating.

Production Statistics from Census of Manufactures in preliminary mimeographed form for the period and commodities named; Sand-Lime Brick, 1926; Pulpwood Consumption and Wood-Pulp, 1926; Sulphuric Acid and Acid Prosphates consumed, sold, and in stock—The Fertilizer Industry: 1926, last six months.

Determination of the Magnetic Induction in Sheet Steel, by R. L. Sanford and J. M. Barry. Bureau of Standards Scientific Paper 545. 10 cents.

United States Government Master Specifications on the following materials, issued under Bureau of Standards Circular numbers indicated: No. 324, Manila Rope; No. 326, Cotton Rope. 5 cents each.

Origin and Development of the Continental Steel Entente, by J. J. W. Palmer. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 484. 10 cents.

The Zinc White Industry in France, by Commercial Attache Chester Lloyd Jones, Paris. Bureau of Foreign and Domestic Commerce Chemical Division Special Circular 176 (Mimeographed).

Safety Code for the Use, Care, and Protection of Abrasive Wheels. Bureau of Labor Statistics Bulletin 436. 10 cents.

Oil Content of Flaxseed, with Comparisons of Tests for Determining Oil Content, by D. A. Coleman and H. C. Fellows. Department of Agriculture Department Bulletin No. 1471. 10 cents.

A Physico-Chemical Study of Scale Formation and Boiler-Water Conditioning, by R. E. Hall and others. Carnegie Institute of Technology Bulletin 24. Obtainable only from Carnegie Institute of Technology at $2.00.

The Plant Notebook

An Exchange for Operating Men

Permanent Filter for Routine Testing

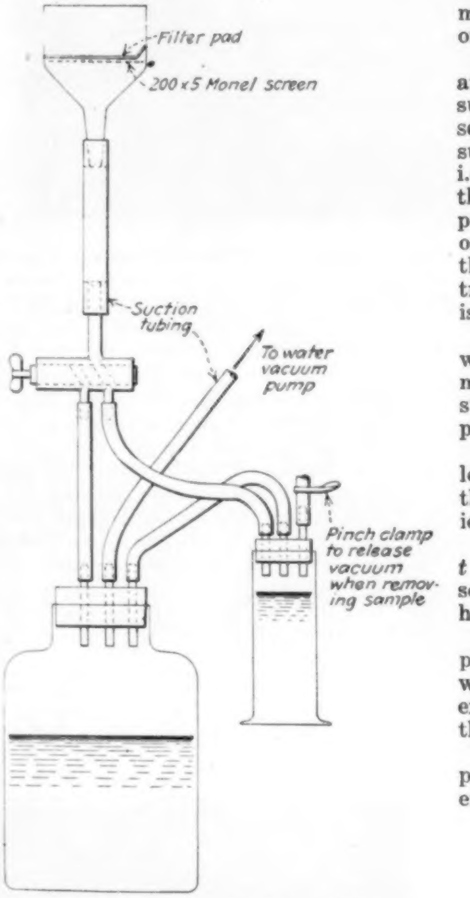
By Paul Stegeman
Midland, Mich.

In one of our processes we precipitated a heavy gelatinous hydrate in a hot concentrated mother liquor. It was necessary to run a check titration on the mother liquor every hour and sometimes oftener in order to determine the soluble alkalinity. It was necessary to get the sample quickly in order to determine a definite end point, but the precipitate was so gelatinous that it was impossible to filter it in a funnel under suction without breaking the paper. The precipitate was also so finely divided that it was impossible to wheel it out in a centrifuge, as it left a very cloudy mother liquor which titrated much higher than a clear sample. The only easy way to get a quick sample was to use a large hand folded filter paper, but this proved to be a rather expensive procedure as the paper costs about 3½ cents a piece, and the bill for these papers was generally from $40 to $50 monthly.

In order to get around this difficulty, I devised a simple permanent filter shown in the accompanying drawing, which obviated the use of filter paper altogether and gave a quick sample sufficiently clear to give a comparatively accurate titration.

In making this filter a 4 in. Beuchner was taken and a piece of monel metal screen of 200x4 mesh was cut to fit the bottom and cemented in with liquid porcelain cement. On this was laid a loose pad of coarse filter cloth. The first filtrate coming through was, of course, rather cloudy and was passed into the large receiver shown on the sketch. In 10 or 15 seconds the pores in the cloth became sufficiently filled with the hydrate so that it made its own filter bed and the filtrate then became quite clear. By turning the two-way stop cock, the filtrate was then collected in the graduate and was ready for titration. The pad was then lifted out by the attached ear and rinsed off, put back into the Beuchner, dried, and was then ready for the next sample.

It was found that it was impossible to fit the filter pad, when used alone, snugly enough to make it filter clear as most of the sample was drawn down through any openings left around the circumference. However, with the fine mesh screen underneath, the precipitate would immediately seal off the screen at any point where there was any considerable leakage and the filtrate would then run clear. If the screen in time became so plugged that it interfered with the rate of flow, it was washed with acid and then became as good as new. The filter pads were made from scrap ends of filter cloth and so cost practically nothing.



Setup of Apparatus Used for Making a Permanent Filter for Routine Testing

This arrangement was found very satisfactory, giving greater speed in filtering and as mentioned a saving from $40 to $50 per month.

Economical Tank Designing

By C. A. Andsten
Brooklyn, N. Y.

Mr. Samuel Cottrell has presented a method in the August, 1926, issue of *Chem. & Met.* for the design of the most economical cylindrical tank. He is thereby dealing with two factors "surface" and "length of seams"; i.e. he determines the tank for which cost of material plus cost of seam is lowest; in each case the surface of the tank and the length of seam varying with the ratio of height to radius, but the price of material per sq.ft. being constant. The computation is easy and by using diagrams one can read the answer at once. His method will, therefore, undoubtedly be of value to many engineers dealing with problems of this kind. The purpose of this article is merely to extend Mr. Cottrell's idea in order to make it more general.

If we have "the weight of material" and "price per pound" instead of "the surface of the tank" and "price per sq.ft.," we will have to look at the subject in a somewhat different way; i.e. we also make the thickness of the tank a variable, which is dependent upon the radius and the ratio of height to radius. The thickness of the material does not vary in Mr. Cottrell's method; i.e. the "price per sq.ft." is the same for any radius.

To illustrate this let us assume that we are building a vacuum-tank. The material has to be strong enough to stand an external pressure of 1 atmosphere.

Using Mr. Cottrell's method the following equation would be the basis for the determination of the most economical tank.

$$t = m(2\pi r^2 + 2\pi rh) + n(4\pi r + h)$$

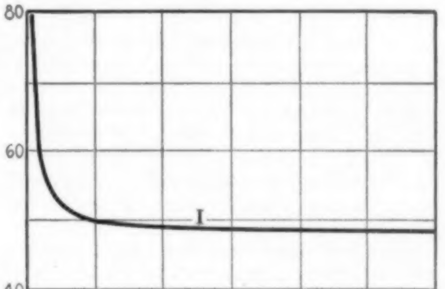
t = cost, m = price of material per sq.ft., n = price of seams per ft., h = height, r = radius.

By differentiating this expression and putting the result $= 0$, in the usual way, we will find the ratio, h/r, which expresses the tank that can be built at the lowest expense.

But we feel that there are two important factors not taken into consideration in this method.

1. We want to know not only the minimum, but several prices around the minimum.
2. The minimum can not be expressed by the surface, but by the weight of the material.

If we know several points around the



Curves for Determination of Most Economical Tank Design
I gives weight of material in lb.
II gives length of seams in ft.

Gasoline Locomotive Proves Economical for Industrial Plant Switching

The Whitcomb locomotive, shown here operating in the plant of the Dunlop Tire & Rubber Corporation, Buffalo, N. Y., has displaced two steam locomotives for switching service. It has pulled as much as 1,000 tons of train load, moved 1,078 cars in twenty-four hours and developed a draw-bar pull of close to 15,000 lb. Because it is only in operation when in use, there being no stand-by charges, it has proven highly economical.

minimum we can see how the price of the tank will change with the ratio h/r. Perhaps the changes in some cases, for instance h increasing, will be comparatively small, so that we may ignore h/r in selecting the most convenient tank, which will also be practically the most economical tank.

On the other hand we know that the thickness of the material will vary with the ratio h/r and the price will not be dependent upon the surface, but upon the weight of the material; a larger surface in some instances being lighter than a smaller surface.

If we use Bach's formulas to determine the thickness of the material, we will find the following equation to be the basis for the determination of the most economical tank.

$$t = (2\pi r^2 + 2\pi rh)\frac{pr}{2k}$$

$$\left(1 + \sqrt{1 + \frac{a}{p}\frac{h}{h + 2r}}\right)$$

$$sm + (4\pi r + h)n$$

m = cost of material per pound, p = external pressure, k = constant depending upon kind of metal, a = constant depending upon workmanship, etc., s = specific gravity of material.

A determination of a minimum would be troublesome and would not give a satisfactory result. But if we study the two curves I and II we can determine the most economical tank. I gives the weight of material in pounds. II gives the length of seams in feet. The values are of course relative and not absolute, but the curves give a true picture of the variations. The figures on the abscissa give us the values of the ratio h/r. We can see that the cheapest tank would have h/r = about 6.28 i.e. $h = 2\ r$. An increase of h/r would very slowly change the price the material being less, the length of the seams increasing slowly. But this is true only to a certain extent. If we have to build a small tank and make h/r large we would perhaps have to select a material heavier than needed, the calculated material being too thin to work without difficulty. If on the other hand we decrease h/r, (r increasing) we will find that at a certain point the changes in price will be very great, both the weight of the material and the length of the seams increasing rapidly.

To illustrate this let us assume that we have to build a 200 gal. tank which has to stand an external pressure of one atmosphere. The table gives us the changes in weight and length of seams, when we change the ratio h/r:

h	r	Weight in Lb.	Length of Seams in Ft.
6.90	1.10	434	20.72
8.16	1.02	425	20.97
5.12	1.28	502	21..0

These figures are also relative and not absolute because the top and the bottom have been figured flat which of course would not be advisable in building tanks of this kind.

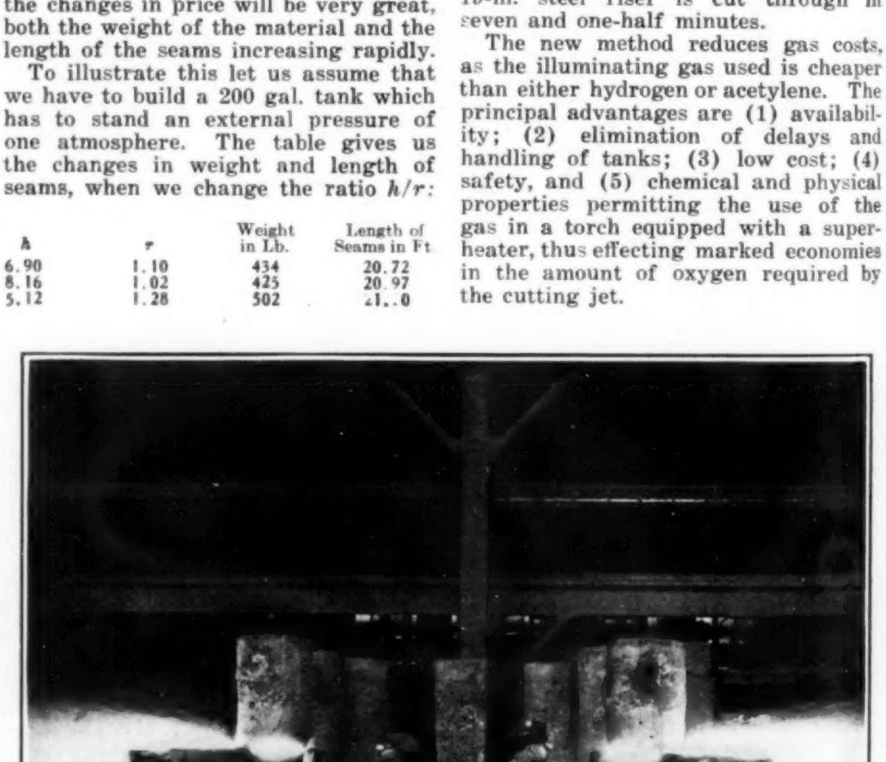
We can now draw the conclusion that we need pay little attention to h/r as long as we are dealing with tanks of common dimensions.

To make r very large would seldom be convenient and that is the only way in which the expenses of material and length of seams could run up very high.

Illuminating Gas for Cutting Steel

Since the adoption of illuminating gas to replace acetylene, hydrogen and other fuel gases in combination with oxygen for metal cutting, the General Electric plants have found many valuable uses for this new metal cutting tool. The accompanying photograph shows two operators in the Everett plant of that company cutting risers from a steel casting with oxy-illuminating gas torches. By this method a 19-in. steel riser is cut through in seven and one-half minutes.

The new method reduces gas costs, as the illuminating gas used is cheaper than either hydrogen or acetylene. The principal advantages are (1) availability; (2) elimination of delays and handling of tanks; (3) low cost; (4) safety, and (5) chemical and physical properties permitting the use of the gas in a torch equipped with a superheater, thus effecting marked economies in the amount of oxygen required by the cutting jet.



Cutting Risers from Castings with Illuminating Gas at the Everett Steel Foundry, Everett, Mass.

Equipment News

From Maker and User

V-Type Belt

The B. F. Goodrich Rubber Co., Akron, Ohio, has recently patented an endless driving belt of the side-driving V-type, made of vulcanized rubber and fabric. It is claimed that this new belt solves the problem of a durable belt for this purpose at a reasonable price.

Arch Tile

Geo. P. Reintjes Co., Kansas City, Mo., is marketing a patented arch tile for furnaces that is said to provide for more economical and easier construction and maintenance.

This tile forms its own arch, requiring no temporary arch centers or skewbacks. No iron or steel is necessary in an arch made from it. Only two shapes of tile are needed regardless of the thickness of walls or width of spans, or whether the door jambs are square or beveled. This eliminates the need for several shapes heretofore required.

It is also claimed that with this tile no leveling is required as with sprung arches. The units remain level with adjacent brickwork without any leveling medium. Each step up is equal to a brick course. The arch is built up in sections the width of one brick course.

The tapered key of this tile is said to facilitate repairs. Replacement arches can be driven to a tight fit without disturbing overhead brickwork. The interior section of the arch can be repaired without interfering with the remaining sections.

Liquid Level Gage

The National Oil Gauge Co., Chicago, Ill., has recently placed on the market the "Oilmetre" for indicating the level of liquids in storage. The standard gage will indicate up to 5,000 gal., but may be calibrated for any capacity without affecting the accuracy.

This gage contains no moving parts, springs or floats, nor are there any electrical wiring or contacts. It is ruggedly built to stand up under severe operating conditions. Installation consists of mounting the indicator and running a single $\frac{1}{4}$-in. tube to the tank.

The indicator can be located in any convenient location. The column is large enough to be read at a distance.

This gage can be used with water, oil, acids or alkalis, the tube being the only part coming in contact with the liquid and this being made of a suitable material depending on the requirements.

There are two scales on the column, that at the right showing the actual liquid level and that at the left reading direct in gallons, being calibrated for the particular tank where used.

Welding Electrode

A new type of welding electrode which combines the characteristics of a fluxed electrode and the quality of bead finish and the cleanness in handling of a bare welding electrode has been introduced by the Merchandise Department of the General Electric Co., Bridgeport, Conn. Recommended for the general welding of steel, the electrode has a uniform flowing quality. The absence of sputtering or spattering, characteristic of the usual commercial bare welding wire, is one of the features of the new material. The elimination of the erratic arc condition leads to a deposit of more material with the same consumption of electrode per kilowatt-hour. The electrode penetrates quickly and produces high tensile strength and unusual ductility and elongation.

The electrode, which has been designated GE Type F, is furnished in $\frac{3}{32}$-, $\frac{1}{8}$-, $\frac{5}{32}$-, $\frac{3}{16}$- and $\frac{1}{4}$-inch sizes. The standard package is 50 pounds, burlapped. It is also furnished on steel reels (approximately 200 pounds) or in coils of approximately 150 or 200 pounds.

Engine Driven Welder

The General Electric Co., Schenectady, N. Y., announces another addition to its line of welding equipment, a small engine driven welding outfit. This set incorporates the G.E. WD-11 welding generator with a continuous rating of 150 amperes and a one-hour rating of 200 amperes, the current range running from 50 to 250 amperes.

The generator is driven by a Continental P-20, power unit rated 18.22 horsepower S.A.E. and capable of developing 23.5 horsepower at 1,400 r.p.m. The generator is equipped with a control panel, rheostat and self-adjusting stabilizing reactor. The engine accessories include a radiator, pressure feed lubricating system with oil pressure gauge and indicator, vertical tube gravity feed carburetor, air cleaner, centrifugal governor, starting crank, 10-gallon gasolene tank, tool box and sheet metal hood with sheet metal side panels which can be locked in place.

The outfit is particularly adaptable for oil field work, shop and garage work where portability is desirable or for any application where no power supply is available for driving a motor generator type of welder.

Among the advantages claimed for this combination are low first cost, light weight and reliability. Tests have shown the outfit capable of standing up under hard service and overloads. The set is mounted complete on a structural steel base so designed as to facilitate easy moving from place to place.

Furnace Wall Anchor

The Plibrico Jointless Firebrick Co., Chicago, Ill., has developed a new anchoring method for jointless furnace lining walls. This anchor, called the "Flexo-Anchor," allows a monolithic furnace wall to move in any direction with expansion and contraction, thus allowing for the different characteristics of the brick setting and the refractory lining.

In the new anchor a hook is secured in the brick setting wall. Then as the monolithic wall is built up the anchor is placed over the hook, being subsequently embedded in the wall. This anchor can also be used with repair jobs.

Electric Hoist

A new "Lo-Hed" electric hoist that can be mounted in a fixed position, either overhead or on the ground, or can be placed on skids and used as a portable hoist is announced by the American Engineering Co., Philadelphia, Pa.

Uses for the hoist include applications for contractors' work, derricks, as a car puller, mine hoist, elevator work, ash handling, coal tipples, loading booms, pulling loads up inclines, furnace door lifting, handling spouts in steel mills, handling carcasses in slaughter houses and in general all sorts of lifting and hauling that can be done with a hoist of this type in a fixed position.

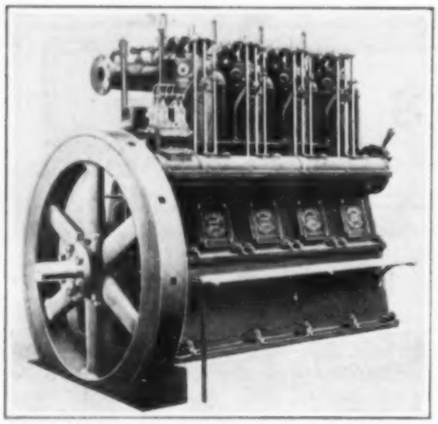
The standard machine consists of a smooth drum, driven by a motor through a train of spur gears, all mounted on a common bedplate. It is furnished in sizes for handling loads from 500 to 4,500 pounds.

Motor and gears are completely enclosed. Gears are of drop forged steel heat treated and run in an oil bath. Hyatt "high duty" roller bearings are mounted on the ends of all gear shafts. The cover of the gear case is easily removable.

The drum has large flanges which prevent the rope jumping the ends and give maximum storage capacity. One bearing of the drum shaft is lubricated by splash from the gears and the other by an Alemite fitting.

The motor is a fully enclosed, ball bearing motor, especially designed for hoist service. Either D.C. or A.C. motor can be furnished. The controller is of the single speed, reversing drum type.

When desired, various modifications in the hoist can be made, such as supplying grooved drums, air motors or steam motors, push button and remote control, holding and lowering brakes and extension shafts with additional heads.



M.W.M. Benz Solid Injection Diesel Engine Now Marketed in the United States

Diesel Engine

The Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y., is now marketing, in the United States, the German MWM Benz Diesel engines, in horsepowers from 80 to 240, at 327 r.p.m. This engine is illustrated by the accompanying photograph.

Automatic Welder

A new design of automatic arc welder has been introduced by the General Electric Co., Schenectady, N. Y. With this equipment, the operator needs but to push a button to start the sequence of operations which produce the weld without any further effort or skill on his part.

The new welder starts the arc by first touching the electrode to the work and then withdrawing it, thereafter maintaining a constant arc length by feeding the electrode wire to the weld at the exact rate of speed necessary to replace the electrode fused into the weld. It is claimed that the new equipment will perform these operations more rapidly and with a greater degree of accuracy than is possible by the most expert hand operators.

The automatic welding head incorporates the necessary mechanism for feeding the electrode to the arc, and consists essentially of a pair of feed rollers geared to a constant speed motor through a magnetic clutch. The gearing and feed mechanism are contained in one housing to which the motor is bolted.

The feed rollers feed the welding wire through the nozzle to the arc. The distance and pressure between these rollers is readily adjustable. Each welding head is equipped with a set of nozzles for $\frac{3}{32}$-inch, $\frac{1}{8}$-inch, $\frac{5}{32}$-inch, $\frac{3}{16}$-inch and $\frac{1}{4}$-inch wire.

The speed of wire feed may be adjusted by means of a selective gear changer which permits the gear ratio to be altered at will to adapt the speed of the feed rollers to the size of wire and the welding current used. Three gear speed changes can be made by moving the gear shift pin which extends from the rear of the gear housing. An additional finer adjustment can be made by means of a rheostat in the field of the motor.

Provision is made for pointing the electrode backward or forward in the line of weld, and also for moving it sideways. The pointing of the electrode is obtained by rotating the head on its horizontal shaft, and the lateral movement by means of the handwheel on the front of the head.

The control equipment consists of a control panel, a meter panel and a push-button station. The control panel mounts the main line contactor for the welding circuit and two smaller contactors for interlocking the travel motor with the arc. By means of auxiliary contacts, the line contactor controls the starting and stopping of the feed motor. The magnetic clutch is operated forward or backward by a voltage relay, the coil of which is connected across the arc. Thus the electrode is fed to or from the work automatically, adjusting itself to any irregularities in the surface of the work. One rheostat controls the speed of the feed motor and the other controls the voltage setting of the arc.

Welded Tubes

The Chrome Alloy Tube Corporation, 26 Broadway, New York, N. Y., is now marketing stainless iron welded seam tubing. This tube is made by welding and the weld worked during the welding process, thus producing a clean, homogeneous weld free from oxide inclusions. For this reason the weld shows the same relative resistance to corrosion and heat action as does the body of the tube.

These tubes are produced in any of the chrome irons or stainless irons. In addition, tubes are produced from chrome-molybdenum alloys, copper-nickel alloys, copper-aluminum alloys and other alloys.

Tubes are made in the following standard sizes:

Outside Diameter	Wall
From $\frac{3}{16}$ in. to 1 in.	22 gage (.028 in.)
From $\frac{3}{16}$ in. to 2 in.	20 gage (.035 in.)
From $\frac{3}{16}$ in. to $2\frac{1}{2}$ in.	18 gage (.049 in.)
From $\frac{3}{16}$ in. to $3\frac{3}{16}$ in.	16 gage (.065 in.)
From $\frac{1}{4}$ in. to $3\frac{3}{16}$ in.	14 gage (.083 in.)

Other specifications for the tubes include diameter tolerance of plus or minus 0.003 in. Either inside or outside diameter can be controlled to these limits but not both. The wall thickness tolerance is plus or minus 10 per cent. Lengths are available from 8 to 10 ft. depending upon diameter and gage, although larger diameters, greater lengths and heavier or lighter walls can be arranged for. Square section tubing is available up to $2\frac{1}{2}$ in. square and rectangular sections up to 3 x 2 in.

Compressor-Pump

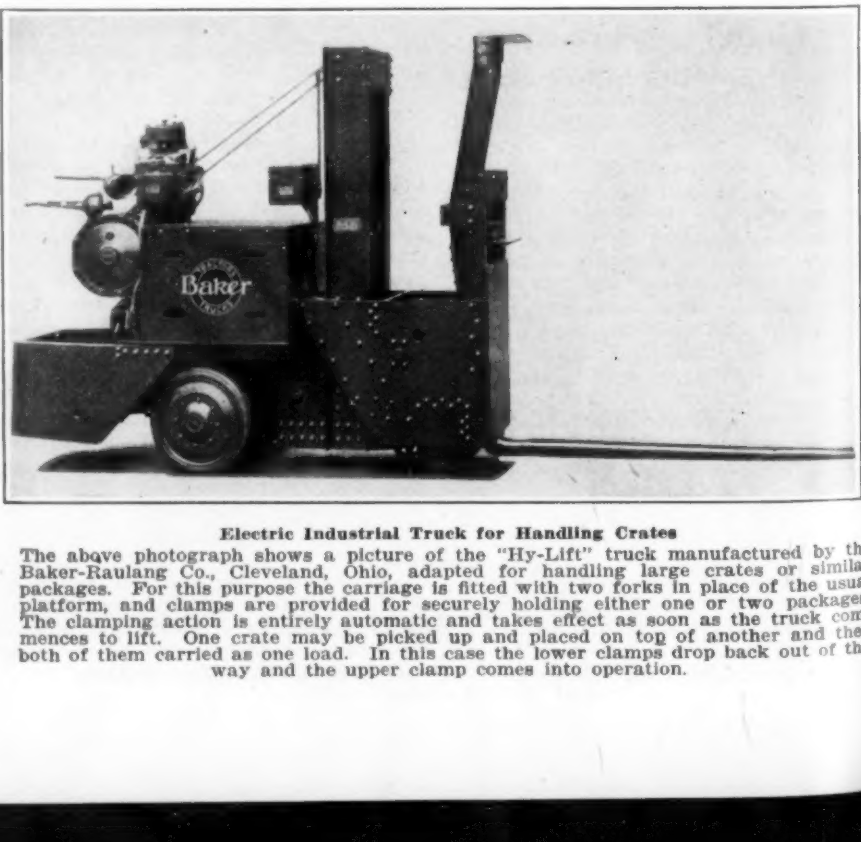
The Ingersoll-Rand Co., 11 Broadway, New York, N. Y., have developed a combined portable air compressor and water pump outfit. It consists of a standard Type 20 gasoline-engine-driven compressor and a Cameron air-driven pump, both mounted on the same portable carriage.

The pump operates by air supplied from the compressor. The compressor can also be used to operate all sorts of air tools.

Vibrating Screen

A new design of mechanically vibrated screen has been developed by Stedman's Foundry & Machine Works, Aurora, Ind. One of the outstanding characteristics of this screen is that the rate and intensity of vibration can be easily adjusted to suit the material being screened. The normal rate of the vibrator shaft is 190 r.p.m., at which rate the screen cloth receives 1,500 impulses per minute. The speed of this shaft can be adjusted, thus changing the rate of vibrations. The intensity of vibrations is regulated by adjusting the stops, which increases or decreases the force of the fall of the vibrator under the spring tension.

The vibrator unit is contained in a dust-tight case. The mechanism consists of an eight-pointed cam running

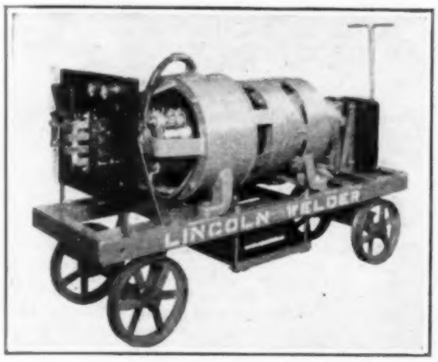


Electric Industrial Truck for Handling Crates

The above photograph shows a picture of the "Hy-Lift" truck manufactured by the Baker-Raulang Co., Cleveland, Ohio, adapted for handling large crates or similar packages. For this purpose the carriage is fitted with two forks in place of the usual platform, and clamps are provided for securely holding either one or two packages. The clamping action is entirely automatic and takes effect as soon as the truck commences to lift. One crate may be picked up and placed on top of another and then both of them carried as one load. In this case the lower clamps drop back out of the way and the upper clamp comes into operation.

in oil, which lifts the vibrator yoke against spring tension and then drops it onto the adjustable stops.

The angle or slope of this screen can be widely varied to suit the material being handled. The screen cloth tension is maintained by means of stretching bolts. The cloth is carried on removable trays and can be changed readily. If desired, this screen can be supplied totally enclosed.



All-Welded Portable Arc Welder

Arc Welder

The Lincoln Electric Co., Cleveland, Ohio, has developed a new model arc welder in which welded steel construction is used practically throughout. In the accompanying illustration is shown the 300-ampere a.c. welder. In this outfit there are only two gray iron castings, weighing about 15 lb. total, the remainder of the device being of welded steel construction. Other sizes and types of welders are also being changed over to this same type of construction.

Welding Rod

Lincoln Electric Co., Cleveland, Ohio, is now marketing a new line of "dipped" welding rod, known as "Stable-Arc" rod. This rod is available in larger diameters than other types have been and is carried in all sizes up to ⅜ in.

It is claimed that the new rod permits the use of much higher currents, resulting in greater welding speed and thus decreasing labor costs. The greater heat is also said to give better penetration and a smoother finished bead. This heat also results in an annealing action that increases the ductility of the weld. Current densities of 15,000 amperes per sq.in., and over, can be used.

It is also claimed that the rod has a decreased "splutter" in the arc, giving less spattered metal and hence more metal deposited per lb. of rod used. This rod is sold in 50-lb. bundles wrapped in burlap and in lengths of 14 in., or longer if desired.

Grease Cup

A new design of grease cup, fitted with Alemite or Zerk fittings, and made of malleable iron, is being marketed by the Link-Belt Co., Chicago, Ill. This cup is of the compression type and is made hexagonal in shape, giving a good grip for hand or wrench. It is called the "Hex-Top."

It is claimed that the combination of compression cup and Alemite fittings is an improvement over either article used separately. For instance, in a long belt conveyor, the cups can be all filled at once from a grease gun. The cup holds a reserve of grease and, thereafter, on occasion slight screwing down by hand or wrench is all that is necessary until a general refilling is required.

Manufacturers' Latest Publications

Hercules Powder Co., Wilmington, Del. —A loose-leaf book on nitrocellulose for the manufacturer of lacquers, coated textiles, celluloid, collodion, and miscellaneous pyroxylin solutions. This book gives very full information on the subject and additional leaves will be issued as further information is available.

Sturtevant Mill Co., Boston, Mass.—The first issue of a periodical entitled "Experience" which will contain articles on disintegrating, separating, mixing, conveying and similar processes.

Graver Corporaton, East Chicago, Ind.—A catalog giving specifications and layouts for bulk storage tank installations, illustrated with many photographs of bulk storage stations.

Crescent Refractories Co., Curwensville, Pa. — Two loose-leaf booklets of charts, formulas and rules for users of refractories, Series 1 being general while Series D1 deals with cupolas and core furnaces.

Crouse-Hinds Co., Syracuse, N. Y. — Folder No. 51 and Bulletin No. 2098—The first of these deals with "Obround" Condulets and the second with self-threading unions and connectors.

Fisher Scientific Co., Pittsburgh, Pa.—Leaflet describing "Scimatco" rubber laboratory tubing.

The Truscon Laboratories, Detroit, Mich. —Folder describing "Stone Tex" a protective coating for buildings.

Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.—Catalogs Nos. 575 and 666—The first of these is a new illustrated general catalog of elevators and conveyors and the second describes a new design of power hoe or drag scraper.

Stedman's Foundry & Machine Works, Aurora, Ind.—Bulletin No. 22—A leaflet describing a new design of mechanically vibrated screen.

Edison Lamp Works, Harrison, N. J.—Bulletins LD 147A and LD 155—The first of these deals with lighting for traffic control, while the second contains definitions of many illumination terms.

Leeds & Northrup Co., Philadelphia, Pa. —Catalog No. 20 and Bulletin No. 781—The first is a general catalog on the design and use of all types of galvanometers, while the second describes electrically operated CO_2 meters.

General Electric Co., Schenectady, N. Y. —New bulletins as follows: GEA-6, dealing with the "500" series of squirrel cage motors; GEA-140, describing type CR1034-K1 hand starting compensators for squirrel cage motors; GEA-250, describing type CR3204 drum type controller equipment for 2 and 3 phase slip-ring induction motors; GEA-416A, describing type CR7051 automatic starting compensators for squirrel cage motors; GEA-530A, describing type MT control equipments for direct current series wound crane hoist motors; GEA-570, dealing with types CR1034-K17, -K21 and -K22 hand starting compensators, dead-front cabinet type, for squirrel cage motors; and GEA-753, describing type CR9511 shoe-type solenoid brakes for direct current motors.

Palo Co., 153 W. 23rd St., New York, N. Y.—Two new leaflets describing various laboratory supplies.

Duriron Co., Dayton, Ohio—Several new bulletins as follows: bulletin No. 142-A, bulletin on the design and use of tank outlets and steam jets made from Duriron; bulletin No. 144-A, dealing with valves, cocks and ejectors made from Duriron; bulletin No. 145, describing reciprocating pumps made of Duriron; bulletin No. 147, describing the No. 40 Duriron centrifugal pump; a new general bulletin on "Alcumite" as a corrosion-resistant; and a bulletin describing dissolved alum systems for feeding alum in the paper industry.

Sement-Solvay Engineering Corporation, 40 Rector St., New York, N. Y.—Three new bulletins: No. 312 refers to Steere water gas machines with the "Backrun"; No. 314 describes a grate poker for water gas generators; and 315 also deals with the grate poker.

International Nickel Co., Inc., 67 Wall St., New York, N. Y.—Bulletin No. 10—A discussion of chrome nickel steel as used by the Milwaukee Electric Railway & Power Co., entitled "Chrome Nickel Steel in Special Trackwork."

U. S. Stoneware Co., Akron, Ohio. — Photo-engraving Bulletin No. 201 — A folder describing acid tanks, vats, trays and similar equipment of acid-proof stoneware for photo-engraving, electrotyping, rotogravure and allied industries.

New Departure Mfg. Co., Bristol, Conn. —A new folder on the application of ball bearings to machine spindles.

Blaw-Knox Co., Pittsburgh, Pa.—A new bulletin describing the layout and application of the "Inundation" system for the mechanical production of concrete of uniformly constant properties.

Celite Products Co., 11 Broadway, New York, N. Y. — Bulletin No. 325-B — New bulletin on the use of Celite as an admixture in concrete.

Dust Recovery & Conveying Co., Cleveland, Ohio—Bulletin No. 9 (revised)—A description of the new dust collecting equipment installed at the cement plant of the Ford Motor Co.

Hendrick Mfg. Co., Carbondale, Pa.—Bulletin describing "Mitco" interlocked steel grating for industrial flooring and similar purposes.

Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y.—Bulletin No. 774—A catalog covering the type RH40 Benz Diesel engine, in horsepowers from 80 to 240, now marketed in the U. S. by this company.

Midwest Air Filters, Inc., Bradford, Pa. —A new folder describing the horizontal automatic self-cleaning air filter; and a reprint of an article by John H. Fedeler on "Air Filters in the New York Public Library."

H. H. Robertson Co., Pittsburgh, Pa.—Two new folders on asbestos protected corrugated sheet steel for buildings.

Anglo-American Mill Co., Owensboro, Ky. —Two new catalogs, one describing the MacLellan batch mixer, and the other describing the "Miracle Ace" hammer mill.

Burt Manufacturing Co., Akron, Ohio.—A new catalog and a leaflet describing and illustrating the application of various types of ventilators.

Cooper Hewitt Electric Co., Hoboken, N. J.—Catalog No. 500—New general catalog of the "Work-Light" for industrial lighting, describing industrial lighting layouts and illustrated with photographs of installations.

Sangamo Electric Co., Springfield, Ill.—A bulletin entitled "Rates and Load Building," discussing electric service rate systems and factors involved in load building.

Milwaukee Electric Crane & Mfg. Co., Milwaukee, Wis.—A bulletin of the economical handling of lumber by means of cranes and monorail hoists.

International Combustion Engineering Corporation, 200 Madison Ave., New York, N. Y.—A bulletin describing the rebuilding of boilers at the Ford Motor Co., by means of which capacity was doubled.

Foxboro Co., Inc., Foxboro, Mass. — A folder describing dial type indicating thermometers.

S. F. Bowser & Co., Inc., Fort Wayne, Indiana—A folder describing floodlights of the Cahill Giant Projector type.

American Blower Co., Detroit, Mich.—Bulletin No. 1033—Bulletin of Sirocco blowers for use with oil burners.

Hardinge Co., York, Pa.—Bulletin No. 17-A—A new booklet entitled "Dry Grinding with the Hardinge Conical Mill and Reverse Current Air Classifier."

The Bristol Co., Waterbury, Conn. — Bulletin No. 358—A bulletin of instructions for users of pyrometers.

Cochrane Corporation, Philadelphia, Pa. —Bulletin No. 674—A bulletin describing the use of steam separators as steam purifiers.

Ajax Electrothermic Corporation, Trenton, N. J.—A new bulletin describing the operation of Ajax-Northrup high frequency induction furnaces for metal melting.

Standard Conveyor Co., North St. Paul, Minn.—A new folder describing hand power and electric power tiering machines.

Seamless Steel Equipment Corporation, 26 Broadway, New York, N. Y.—Catalog of seamless steel forged, rolled and drawn products for high pressure and temperature requirements.

Hills-McCanna Co., 2025 Elston Ave., Chicago, Ill. — A folder showing various types of lubricators made by this company.

Patents Issued May 10 to May 31, 1927

Paper, Pulp and Sugar

Rotary Screen for Screening Pulp and Paper Stock. Ernest W. Lindquist, Helsingfors, Finland.—1,627,655.

Composition for Use in Making Sulphate or Kraft Pulp and Process of Making Same. Herman B. Kipper, Muskegon, Mich.—1,629,393.

Process of Making Ligno-Tanning Material from Waste Sulphite Liquor. Viggo Drewsen, Brooklyn, N. Y., assignor to West Virginia Pulp & Paper Company, New York, N. Y.—1,629,448.

Fourdrinier Machine and Process of Paper Making. George Stanford Witham, Jr., Hudson Falls, N. Y.—1,629,607.

Primary Strainer for Cellulose, Wood Pulp, Etc. Christian Martin Hanssen, Mjondalen, Norway, assignor to A/S. Thunes Mek. Verksted, Skoyen, Norway.—1,629,619.

Paper-Making Apparatus. Hervey G. Cram, Millinocket, Me., assignor to Great Northern Paper Company, Millinocket, Me.—1,629,681.

Apparatus for and Method of Screening Pulp. Jerry W. Stevens, Cloquet, Minn., assignor to Northwest Paper Company, Cloquet, Minn.—1,629,812.

Process for Extracting the Pure Cellulose from the Bagasse of Sugar Cane. Earnest Charles Hemmer Valet, Mexico City, Mexico.—1,630,147.

Rubber and Synthetic Plastics

Vulcanization of Rubber. Cecil John Turrell Cronshaw and William Johnson Smith Naunton, Manchester, England, assignors to British Dyestuffs Corporation Limited, Manchester, England.—1,627,636.

Process for Combining Halogen-Containing Materials with Rubber or Similar Substances and Products Resulting Therefrom. Charles E. Bradley, Montclair, N. J., and Willis A. Gibbons, New York, N. Y., assignors to The Naugatuck Chemical Company.—1,627,725.

Method of Manufacture of Coagulum-Rubber Articles. Robert W. Rost, Newark, N. J., assignor of one-half to Andrew F. Bigger, New York, N. Y.—1,628,195.

Molded Product and Process for Its Manufacture. Howard F. Weiss and Ralph F. Norris, Madison, Wis., assignors, by mesne assignments, to C. F. Burgess Laboratories, Inc., Dover, Del.—1,628,206.

Method of Treating Rubber. William G. O'Brien, Akron, Ohio, assignor to The Goodyear Tire & Rubber Company, Akron, Ohio.—1,628,326.

Age-Resisting Rubber Compound and Process of Making Same. Ernest R. Bridgwater, Wilmington, Del., and Donald Howard Powers, Penns Grove, N. J., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,628,528.

Masticating of Rubber and Apparatus Therefor. Harry Clarance Young, Sutton, and Henry Owen Burr, Walney, England, assignors to Dunlop Tire and Rubber Corporation of America.—1,628,869.

Process for Making Molded Rubber Articles from Latex. John McGavack, Jackson Heights, N. Y., assignor to The Naugatuck Chemical Company, Naugatuck, Conn.—1,629,924.

Manufacture of Artificial Silk or the Like. Joe Olgierd Zdanowich, London, England.—1,630,285.

Cellulose Composition. William G. Lindsay, Newark, N. J., assignor to The Celluloid Company, a corporation of New Jersey.—1,630,752.

Petroleum Refining

Apparatus for Cracking and Distilling Hydrocarbon Oils. Stephen L. Tingley, Nitro, W. Va.—1,627,937.

Process for Treating Hydrocarbon Oils. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,628,127.

Treating Hydrocarbons. William S. Hadaway, Jr., New Rochelle, N. Y., assignor to The Texas Company, New York, N. Y.—1,628,143.

Process and Apparatus for Converting Oils. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,628,236.

Process and Apparatus for Cracking Petroleum Oil. Robert T. Pollock, Boston, Mass., assignor to Universal Oil Products Company, Chicago, Ill.—1,628,270.

Art of Sweetening Hydrocarbon Oils. Max G. Paulus, Casper, Wyo., assignor to Standard Oil Company, Whiting, Ind.—1,628,423.

Method of Refining Petroleum. Walter E. Lummus, Lynn, Mass.—1,628,252.

Continuous Process of Treating Oils. Orange J. Salisbury, Salt Lake City, Utah.—1,628,747.

Process of Producing Gasoline. Horace B. Setzler, Coffeyville, Kans., assignor to The National Refining Company, Cleveland, Ohio.—1,629,810.

Process for Cracking Hydrocarbon Oils. Warren F. Faragher and William Arthur Gruse, Pittsburgh, Pa., assignors to Gulf Refining Company, Pittsburgh, Pa.—1,629,908.

Treating Sludge Acid. Francis M. Rogers and Frank V. Grimm, Whiting, Ind., and Gerald L. Wendt, Chicago, Ill., assignors to Standard Oil Company, Whiting, Ind.—1,630,074.

Rustproofing Oil. Robert E. Wilkin, Whiting, Ind., assignor to Standard Oil Company, Whiting, Ind.—1,630,101.

Organic Processes

Smokeless Explosive Powder and Process of Making Same. Francis I. du Pont and Ernest du Pont, Wilmington, Del., assignors, by mesne assignments, to U. S. F. Powder Company, Wilmington, Del.—1,627,691.

Vat Dyestuffs of the Anthraquinone Series. Alfred Holl, Offenbach-on-the-Main, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,627,738.

Process for Removing Sulphur Dioxide and Compounds from Food Products. Ludwig Rosenstein, San Francisco, Calif.—1,623,070.

Condensed Milk and Method of Making Same. James Robinson Hatmaker, Paris, France.—1,626,818.

Process of Making Combustible Gas. William D. Wilcox, Idaho Falls, Idaho.—1,624,644.

Process of Purifying Illuminating Gas. Edward J. Brady, Philadelphia, Pa., assignor to The U. G. I. Contracting Company, Philadelphia, Pa.—1,626,664.

Heat-Resisting Glass. Ralph F. Brenner, Rochester, Pa., assignor to H. C. Fry Glass Company, Rochester, Pa.—1,623,301.

Process of Removing Deterrent Salts from Pickling Liquors. George S. Morgan, Toledo, Ohio.—1,626,623.

Method of Treating Brine. Albert Kelvin Smith, Midland, Mich., and Carl F. Prutton, East Cleveland, Ohio, assignors to The Dow Chemical Company, Midland, Mich.—1,627,068.

Method of Concentrating Fibrous Materials. Samuel H. Dolbear and Victor Zachert, San Francisco, Calif., assignors, by mesne assignments, to Selective Treatment Company Limited, Montreal, Canada.—1,624,163.

Process of Making Fibrous Composition and Articles Produced Therefrom. Edward F. Germain, Saginaw, Mich., assignor to Louis Germain, Jr., Albert A. Germain, and Joseph Heidenkamp, Pittsburgh, Pa., and Edward F. Germain, Saginaw, Mich., trustees.—1,623,588.

Method of Removing Cyanides from Masses Containing the Same. Charles B. Jacobs, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,623,599.

Porous Mass for Storing Explosive Gases and Process of Making Same. Gustaf Dalen, Lindingon, Stockholm, Sweden, assignor to American Gasaccumulator Company, Elizabeth, N. J.—1,623,169.

Colloidal Adhesive Composition. Bradley Dewey, Cambridge, Mass., assignor to Dewey and Almy Chemical Company, Cambridge, Mass.—1,627,278.

Adhesive. William F. Zimmerli, Akron, Ohio, and Carlisle H. Bibb, New Brunswick, N. J., assignors to Johnson & Johnson, New Brunswick, N. J.—1,626,493.

Wood Preservative. Leo P. Curtin, Freehold, N. J., assignor to The Western Union Telegraph Company, New York, N. Y.—1,624,930.

Manufacture of Artificial Silk and the Like from Viscose Solutions. William Porter Dreaper, London, England.—1,626,454.

Process of Producing Algin Compounds and Products Derived Therefrom. Bernard F. Erdahl, Duluth, Minn.—1,625,301.

Inorganic Processes

Method of Treating Wet Raw Materials in the Manufacture of Cement. Johan Sigismund Fasting, Valby, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y.—1,627,553.

Treatment of Cement Raw Materials in Rotary Kilns. Mikael Vogel-Jorgensen, Frederiksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y.—1,627,585.

Process for the Purification of Burner Gases and for Obtaining Chemically-Pure Sulphuric Acid. Max Krafft, Hruschau, Czechoslovakia.—1,627,977.

Process for the Manufacture of Cement. Thomas Rigby, London, England.—1,628,000.

Method of Treating Alunite. Thomas Austin Mitchell, Denver, Colo., assignor to Lafayette M. Hughes, Denver, Colo.—1,628,174.

Process of Making Magnesia and Calcium Pentasulphide. Viggo Drewsen, Larchmont, N. Y., assignor to West Virginia Pulp and Paper Company, New York, N. Y.—1,628,311.

Process of Producing Vitreous Silica. Levi B. Miller, Lynn, Mass., assignor to General Electric Company.—1,628,468.

Process of Making Monoammonium Phosphate. Eldon L. Larison, Frederick F. Frick, and Raymond J. Caro, Anaconda, Mont., assignors to Anaconda Copper Mining Company, Anaconda, Mont.—1,628,792.

Process of Distilling Hydro-Chloric Acid. Louis Charles Drefahl, Lakewood, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,628,829.

Process for the Production of Molybdenum Trioxide and Tungsten Trioxide. Paul Schwarzkopf, Berlin-Charlottenburg, Germany.—1,629,004.

Prepared Sulphur. Francis H. Pough, St. Louis, Mo., assignor by mesne assignments, to Southern Acid & Sulphur Company.—1,629,528.

Treatment of Furnace Gases to Recover Zinc Oxide. John F. Cregan, Pueblo, Colo., assignor to American Smelting & Refining Company, New York, N. Y.—1,628,952.

Manufacture of Arsenate Insecticides. Harold W. Walker, Edgewood, Md.—1,629,557.

Complex Antimony Compounds and Process of Making Same. Hans Hahl, Elberfeld, near Cologne-on-the-Rhine, Germany, assignor to Winthrop Chemical Company, Inc., New York, N. Y.—1,628,838.

Process for Production of Phosphoric Acid. William H. Waggaman and Henry W. Easterwood, Chicago Heights, Ill., assignors to Victor Chemical Works, Chicago, Ill.—1,630,283.

Chemical Engineering Equipment and Processes

Separation of Solids from Liquids. Frank Bachmann, New York, N. Y., assignor to The Dorr Company, New York, N. Y.—1,627,550.

Humidifier. Ragnar Carlstedt, Stockholm, Sweden, assignor to Midwest Air Filters, Incorporated.—1,627,686.

Apparatus for Absorption and Distilling of Hydrocarbons. Daniel L. Newton, Fullerton, Calif.—1,628,055.

Sulphur Burner. Henry F. Merriam, West Orange, N. J., assignor to General Chemical Company, New York, N. Y.—1,629,352.

Grate for Ball Mills and Method of Making Same. Frank Earl Marcy, San Diego, Calif.—1,629,803.

Electrically-Welded Bubble Tower. Richard Stresau, Wauwatosa, Wis., assignor to A. O. Smith Corporation, Milwaukee, Wis.—1,630,037.

Method and Apparatus for Quenching Lithopone. August Sonnin Krebs, Wilmington, Del., assignor to The Krebs Pigment & Chemical Company, Newport, Del.—1,630,267.

Method for Making Carbureted Water Gas. August C. Klein, Jamaica Plain, Mass., assignor to Stone & Webster, Inc., Boston, Mass.—1,630,300.

Method of Making Carbureted Water Gas. Allen E. Shippee, East Providence, R. I., assignor to Stone & Webster, Inc., Boston, Mass.—1,630,316.

Apparatus for Measuring the Flow of Gases. Kenneth L. Tate, Rochester, N. Y., assignor to Taylor Instrument Companies, Rochester, N. Y.—1,630,318.

Apparatus for the Extraction and Recovery of Volatile Liquids. Edward Allan Ironside, London, England.—1,631,036.

Process for the Recovery of Volatile Solvents. Rudolf Oertel, Hanover, Germany, assignor to Metallbank und Metallurgische Gesellschaft Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,631,052.

News of the Industry

Tariff Investigations Ordered for Chemicals

The U. S. Tariff Commission has ordered an investigation of whiting. This commodity now is dutiable at twenty-five per cent ad valorem. The commission has before it an application for an increase in the tariff. The investigation covers ground chalk and precipitated chalk. Those commodities are on the free list and are imported principally from England. Despite the duty increasing imports of whiting are reaching the country from Belgium.

The Commission also has decided to investigate sodium phosphate. It is contended by domestic producers that the present duty of one-half of one cent per pound is insufficient. The investigation will include the mono, di, and tri salts. Particularly keen competition has developed as a result of large importations of the di salt, which is used largely in the weighting of silk.

Another investigation which will begin July 1, when the appropriations for the new fiscal year will become available, will cover the potassium permanganate situation. This commodity now is dutiable at four cents a pound. Imports from Germany are about to destroy the domestic industry, the Commission is advised.

Further investigation is to be made of the linseed oil situation. The report which was submitted to the President covering that situation has been returned with the request that it include information which has become available since the first report was made.

A Tariff Commission hearing on sodium silico-fluoride will be held in Washington June 20.

No new facts concerning the barium carbonate situation were brought out at the hearing held May 23. Domestic producers are asking an increase in the present duty, but this is opposed vigorously by the manufacturers of brick and terra cotta.

Berthelot Centenary Will Be Celebrated in Montreal

Preparations are going forward in Montreal for the celebration in October of this year of the centenary of the birth of Marcelin Berthelot, celebrated French chemist to whom the world owes the synthetical production of numerous hydrocarbons, natural fats and sugars. The celebration, which will be carried out by an executive committee headed by Sir Lomer Gouin, former premier of the province of Quebec, will be arranged to coincide with celebrations in France, where a chemical foundation will be inaugurated in memory of the scientist.

Associated with Sir Lomer Gouin arranging the manifestation in Montreal will be Dr. L. de Lotbiniere Harwood, Dean of the Faculty of Medicine at the University of Montreal; Dr. R. F. Ruttan, Dean of the Research School at McGill and director of the School of Chemistry; Dr. A. Rousseau, Dean of the Faculty of Medicine of Laval University, Quebec; M. L. Bourgouin, president of the Canadian section of the Society of the Chemical Industry of France; Hon. Cyrille Delage, superintendant of public instruction of Quebec, and many others prominent in the educational life of the province of Quebec.

The nature of the celebration has not yet been disclosed, but it will probably take the form of an educational campaign to bring the name of the scientist and his work prominently before the public.

A. D. Little Addresses Meeting of Engineering Foundation

The May meeting of Engineering Foundation was held at a dinner at the University Club, New York, on May 19. This was the annual meeting to which the Foundation has made a practice of inviting a large number of guests. The principal address of the evening was by Dr. Arthur D. Little on "Trends in the Use of Fuel." The research projects now being supported by the Foundation include the experimental concrete arch dam on Stevenson Creek, Calif.; the investigation of dielectric absorption of insulating materials by Prof. Whitehead at Johns Hopkins University; fundamental studies on slags by Prof. McCaffery of the University of Wisconsin; and investigation of the fatigue of metals at the University of Illinois. The Foundation is also cooperating in the investigation of engineering education by the Society for the Promotion of Engineering Education.

Tariff Commission Upholds Bakelite Complaint

The United States Tariff Commission has upheld the complaint of the Bakelite Corporation of New York against a group of importers for alleged unfair acts in the importation and sale of synthetic phenolic resin, form C, and articles made wholly or in part thereof. The decision did not meet with unanimous approval of commission.

German Interests Will Produce Rayon in Tennessee

The American Glanzstoff Corporation has been formed to build and operate a large rayon factory near Elizabethton, Tenn. The corporation will be controlled by the Vereinigte Glanzstoff Fabriken of Elberfeld, Germany. The plant to be constructed will have a capacity of between 10,000 and 15,000 lb. of rayon daily, and will use the viscose process. It will be near that of the American Bemberg Corporation, organized and controlled by the same ir terests and now in operation.

The German parent company, whose capital has a market value of more than $57,000,000, will own a large amount of the common stock of the American Glanzstoff Corporation. Thicompany will have the exclusive right to use in the United States all patents and processes for the manufacture of viscose silk now owned by the German company.

The American company will have a capitalization of $7,000,000 of 7 per cent cumulative preferred stock and 300,000 shares of common stock of no par value. The German company will guarantee the dividends on the preferred stock until 1931. The preferred shares will be offered for public subscription in Amsterdam, but not in New York.

Dr. Baker Visits Europe To Plan for Coal Conference

Dr. T. S. Baker, president of the Carnegie Institute of Technology, Pittsburgh, sailed for Europe from New York on June 10, to perfect plans for the second International Conference on Bituminous Coal to be held in Pittsburgh some time in November, 1928. He will land at Bremen, Germany, and tour the capitals of Europe to renew contacts with the world's leading coal technologists.

In an interview with McGraw-Hill representatives on the eve of his departure, Dr. Baker predicted that the new conference would eclipse in attendance and importance the highly successful first conference of last November, which astonished Pittsburgh with profusion of learned papers.

It will be the aim of the second conference, said Dr. Baker, to cover the advances made in the intervening two years. The conference will feature the problem of nitrogen fixation for agricultural purposes. With this in view Dr. Baker will study the work being done in this field in Germany, France and England.

Technical Papers Featured Cleveland Meeting of A. I. C. E.

Two Symposiums and Ten Plant Excursions Rounded Out Program for Semi-Annual Gathering

NEARLY two hundred members and visitors attended the nineteenth semi-annual meeting of the American Institute of Chemical Engineers held in Cleveland, Ohio, May 31 to June 3. Headquarters was at the Hollenden Hotel, at which the technical sessions and social functions of the Institute took place. Included in the sixteen technical papers were two symposiums —one on chemically-resisting cements and one on rubber. Ten plant excursions and an appropriate social program were arranged by the local committee headed by L. C. Drefahl.

The meeting opened on Tuesday May 31 with the "Symposium on Chemically-Resistant Cements." The chairman, S. S. Sadtler, was unable to be present, his place being taken by H. C. Parmelee, Secretary of the Institute. Included in the symposium were papers on "Cements and Lutes," by S. S. Sadtler; "Cements for Heavy Chemical Industry," by H. B. Bishop, "Cements for Gaseous and Liquid Hydrocarbons," by F. W. Sperr, Jr.; "Oxy-chloride and Other Dental Cements," by W. S. Crowell; and "Silicates of Soda," by J. G. Vail. In the afternoon, plant excursions were made to the Industrial Fibre Co. at which rayon is made by the viscose process, and to the National Carbon Co. where flashlight and radio battery production was seen at the Ever Ready Dry Battery Works. Luncheon was tendered by the National Carbon Co., and the day was concluded by a smoker at the Hollenden Hotel.

Symposium on Rubber

On Wednesday the Symposium on Rubber was held, W. C. Geer presiding. The program comprised "Solvents in the Rubber Industry," by R. P. Dinsmore and W. K. Lewis; "Rubber in Engineering," by J. W. Schade; "Hard Rubber for Chemical Industry," by J. R. Silver, Jr.; and "Development of the Auto Tire," by W. F. Zimmerli. In addition, Marvin Pipkin presented briefly a paper on "Inside Frosted Bulbs for Incandescent Lamps." At luncheon W. R. Hopkins, manager, City of Cleveland, addressed members on "Manager Plan of City Government." The lecture was in reality a broad exposition of all forms of city government. In the afternoon, excursions were made to the General Electric Co., National Lamps Works, where the production of tungsten and molybdenum from their ores and subsequently sintering and the production of wire was inspected. Later the plant of the Arco Co., producers of industrial paints, varnishes and lacquers, was visited.

An outstanding feature was the complimentary dinner to the Institute tendered Wednesday evening by the Grasselli Chemical Co. The dinner was followed by dancing.

On Thursday the B. F. Goodrich Co. at Akron was inspected. All phases of tire production were witnessed and the mechanical rubber goods departments were also inspected. The factory visit was supplemented by a short discussion on use of rubber in the chemical manufacturing industry by H. E. Fritz, development engineer, and by a complimentary luncheon. In the evening the members and guests of the Institute were privileged to hear Dayton C. Miller, professor of physics, Case School of Applied Science, lecture on "Photographing and Analyzing Sound Waves." A remarkable translation and analysis of various sounds, such as that from orchestral instruments and the human voice was demonstrated. An alternate plant excursion was taken by several of the members to the Ohio Box Board Co. and the Ohio Salt Co. at Rittman, Ohio.

On Friday, the concluding day of the meeting, papers were read on "Carbonization of Soft-Wood Saw Dust," by W. S. Beuschlei; "Application of the Three-electrode Vacuum Tube in Chemical Engineering," by H. C. Weber; "Thermodynamics of Air Separation," by B. F. Dodge and C. Housum; "Inhibitors, their Behavior in Laboratory and Plant," by F. N. Speller and E. L. Chappell; "Removal of Rust from Pipe Systems by an Acid Solvent," by F. N. Speller, E. L. Chappell and R. P. Russell; and "Heat Transmission by Radiation from Non-Luminous Gases," by H. C. Hottel. After luncheon at Nela Park, plant excursions were made to the General Electric Co., National Lamp Works, Glass Division at East Cleveland. A visit was also made to the Nela Research Laboratory, at which scientific methods of investigating municipal and industrial lighting problems were demonstrated.

Lime Association Favors Group Sales Promotion Work

At the annual convention of the National Lime Association held in White Sulphur Springs May 17, 18 and 19, a fundamental change in the organization work was made. On recommendation of the Board of Directors the Association voted to reduce the annual dues to one cent per ton of lime sold and to reduce the association organization to a general manager with a limited clerical and technical force to assist at headquarters. All research work and field promotion work of the association was discontinued.

It is proposed that regional or group sales promotion efforts be undertaken under the general supervision of the association, with special contributions from interested companies. But grave doubt was expressed by many of those in attendance at the meeting as to whether such a means would be at all effective for continuing technical work or specialized sales promotion. In order to encourage the organization of such groups the retiring president, Charles Warner, assured the membership that any information which has been gathered by the national association would be available for the support of such new specialized or intensive regional effort. Mr. Warner's report to the association indicates what was perhaps one of the most important reasons for taking this procedure in curtailing expenditures, in the following language:

> "We have gained in potential position as a national body by reason of this (research and promotion) work to an extent that many of us do not realize or appreciate. But those who have been more closely identified with the actual work under way during the past few years know that we have accumulated a great deal of value in our associated effort and that the "fat" so accumulated can at this juncture be of great benefit in continuing to promote many phases of our industry work at much less expense than heretofore."

Under the new plan G. B. Arthur will continue as general manager with offices of the association in Washington, D. C. Mr. Arthur will work under an executive committee consisting of three regional vice presidents; on the new basis there is no president of the association.

New Coke Plant Proposed for New Brunswick

The Canadian Coke Corporation, Limited, of Montreal is investigating the possibilities of establishing a coke plant in St. John, New Brunswick. Max Freedman, who represents the company, recently entered into negotiations with the city officials of St. John. He stated that if satisfactory arrangements can be made with the city as to fixed taxation and other matters, the company will commence construction of byproduct coke ovens almost immediately. It is understood that the St. John plant would be operated by a company to be incorporated under the name of the New Brunswick Coke and Manufacturing Co., producing byproduct coke, coal gas and tar and giving employment to 200 men, the estimated cost of the plant being $2,000,000. In addition it would be necessary to build a coal dock at a cost of $650,000.

Dutch Company Formed To Sell Foreign Potash Salts

The N. V. Potash Export My., which was recently organized in Amsterdam, Holland, for the sale of foreign potash salts in the United States and other countries, has opened a branch office in New York, under the joint management of R. Kunze and R. Gide, who have been appointed managing directors for the United States, Canada, Cuba, and Porto Rico.

This new organization will sell to the American fertilizer manufacturers the potash salts produced by the German and French potash mines, whose business has heretofore been handled for the German interests by the Potash Importing Corporation of America, and for the French potash mines by the French Potash Society.

News from Washington

By Paul Wooton

WASHINGTON CORRESPONDENT OF *Chem. & Met.*

THAT the time has come when synthetic nitrogen is beginning to be an important factor in the promotion of soil fertility in the United States is pointed out by the Department of Agriculture. In a formal statement sent to all newspapers in the country, the Department says:

"The United States, which five years ago had no plants for the fixation of atmospheric nitrogen, now has seven synthetic ammonia installations with a combined capacity of about 80 tons a day. While none of this output is finding its way as yet into agricultural use, it is having the indirect effect of forcing additional quantities of by-product ammonia into the fertilizer market. Growth of the nitrogen fixation industry in the United States, says the United States Department of Agriculture, is certain eventually to be an important factor in promoting soil fertility.

"Projected plans for the expansion of the industry, says the Department, indicate that before many years the products of atmospheric fixation will be competing directly in this country with other sources of fertilizer nitrogen. In the synthetic-ammonia process, the method of atmospheric nitrogen fixation in which practically all commercial effort in this country is concentrated, purified hydrogen and nitrogen gas are made to combine at high pressures and temperatures so as to form ammonia. The ammonia thus obtained is readily transformed into salts suitable for use as fertilizer.

"Fixed nitrogen, because of its limited occurrence in nature, presents the greatest problem in the maintenance of soil fertility. Nitrogen from the air is the logical ultimate source of supply, since free nitrogen comprises four-fifths of the air. The development of atmospheric nitrogen fixation promises greatly to increase the world's supply of nitrogen, and incidentally to promote improvement in the production of fertilizer materials. Already better and more concentrated fertilizer salts are being produced and marketed as a result of the competition of synthetic-nitrogen plants.

"Although Germany, with about 70 per cent of the world's production of atmospheric nitrogen, is still the center of the nitrogen-fixation industry, expansion in other countries has been very rapid in recent years. Atmospheric nitrogen has very largely supplied the increased demand in recent years for inorganic nitrogen. There are three principal sources of combined nitrogen, namely, atmospheric fixation, Chilean nitrate, and by-product ammonia. The progress of the nitrogen fixation industry is indicated by the fact that in 1925 the worlds' production of nitrogen by atmospheric fixation was 607,000 metric tons, compared with a production of 340,000 metric tons of Chilean nitrate, and 330,000 metric tons of by-product ammonia. Probably nearly 90 per cent of this total of 1,277,000 metric tons was used in agriculture."

German-British Chemical Agreement

Despite the denials that have been issued, Washington is convinced that the German-British chemical agreement is a reality. As this is written, confirmation of the agreement from the contracting parties is expected at any time. From the time of the first rumors observers in Washington were convinced that the plan would go through.

It also is fully expected that France will become a party to the accord at an early date. While it is believed that one of the effects of the agreement will be the cessation of cut-throat competition on certain articles, with the result that American manufacturers will be able to compete where they could not before, it is recognized that the principal effect will be to make more difficult the securing of foreign business.

Those in close touch with the American chemical industry say, however, that this combine has done nothing to discourage the drive for foreign trade. They recognize that the very fact that the agreement is necessary is a sign of weakness. Nearly half of the world's chemicals now are produced in the United States. All the rest of the world would have to band together to control an equal output. As 93 per cent of the American production is used in the country there is little the cartel can do that will have much effect on the industry here. It is regarded as significant that American exports did not slump during recent months when decreases were shown by each of the principal producing countries. Our position is expected to grow better steadily as we get into quantity production of more items and apply the lessons of our experience. Moreover, it is believed that our industry is built on a much sounder basis than those in a cartel. That form of organization can grow to the point of becoming unwieldy. It is known that the French were disposed to stay out of the merger but it seems that the Germans have held out attractive inducements.

It is thought that the Germans were alarmed by the steps being taken by the French to build up their own industry. Consolidations were being effected rapidly. The ground had been well prepared for higher tariffs. A Central Committee capable of directing the industry has been created. It was very clear to the Germans that the French industry was maneuvering itself into a strong position to deal with foreign combinations and to prevent the establishment of chemical plants in France by foreign producers.

With the importation in April of more than 11,000,000 pounds of China wood oil there has been a new demonstration of the ability of the Chinese to conduct a normal volume of business under very great difficulty. The fact that the oil is coming out of China at unusual points indicates that considerable quantities of it have been transported long distances on the backs of men. It also is apparent that the military groups recognize that they have nothing to gain and much to lose in preventing the sale of Chinese products abroad.

The completeness of the success of the Guggenheim venture into nitrate production may be judged by the fact that the capacity of the Caya Norte plant is to be increased from 125,000 tons to 500,000 tons.

With the title of "Chief Engineer of the Division of Experiment Stations" Arno C. Fieldner, now in charge of the Pittsburgh station, on July 1 will take over the direction of the work of all the experiment stations of the Bureau of Mines. Under the new arrangement his headquarters will be in Washington. He will succeed Dr. Dorsey A. Lyon who has asked to be relieved of his duties as Supervisor of Stations and as Chief Metallurgist in order that he may concentrate his efforts at the Bureau's intermountain station at Salt Lake City, where the Bureau will co-operate with the University of Utah in an amplification of the service now being conducted at that station.

Mr. Fieldner's intimate knowledge of the extensive research activities of the Bureau's largest station will be brought to bear on all the field stations. He has shown his capacity in maintaining a high plane in the research work at Pittsburgh and also has proven his ability to co-operate successfully with the mining industry. He will make a special study of the work and needs of each station with the idea of improving the grade of work which is being done at the mining experiment station.

No discouragement is felt because of the failure of the core from the first potash well to show the occurrence of potash in promising amounts. Attention is called to the many years of prospecting which preceded the finding of potash in France. J. H. Hedges, the assistant to the Director of the Bureau of Mines, visited the West where he inspected the drilling operations in New Mexico and discussed with land owners prospective drilling on the sites selected by the Geological Survey in Texas.

A report on cresylic acid is understood to have been sent by the U. S. Tariff Commission to the President. Judging from the showing made at the hearing on this commodity, it seems probable that a decrease in the rate of duty would be indicated by the report. The present duty is 40 per cent ad valorem based on the American selling price and 7c. per lb. The case is regarded as a particularly important one because of the extensive use made of cresylic acid in the manufacture of synthetic phenolic resins, disinfectants, antiseptics and germicides. Tri-cresyl phosphate is used as a substitute for camphor in the production of pyroxylin plastics.

Great Britain Will Grant Free Entry To Specified Solvents

Will Encourage Use of Substitutes for Ethyl Alcohol—Imperial Chemical Industries in New Merger

From our London correspondent

THE improvement in business recorded earlier this year is apparently being maintained, unemployment is decreasing uniformly and broadly speaking, the chemical trade also is showing every sign of an impending return to vigor. The breaking of diplomatic relations with the Union of Soviet Socialist Republics is naturally one of the chief topics of conversation. The effect on trade of the cessation of official diplomatic relations is likely to be very small and if anything, it will be more detrimental to Russia than to this country. The loose talk about orders being diverted to other countries is without much substance, particularly as the balance of trade is against this country especially as regards chemicals. In fact, shrewd observers incline to the view that trade will increase rather than decrease. If one were to take stock of the progress of British trade since the costliest industrial dispute on record, one would find that although productivity during the strike was reduced by about 15 per cent, the effect was really disastrous only for the coal industry and for the heavy industries, such as iron and steel, and together with other essential trades, the chemical industry showed not only remarkable stability but has since shown extraordinary powers of recuperation. Dividends have, of course, been affected and will be the worse for wear for another year or more, but confidence in the future has been well reflected by the rise in the value of the best classes of industrial securities.

Chemical markets have shown stability and have not recently been subjected to any violent shocks or interference. It may be of interest to record two interesting features relating to the solvent and glycerine markets. The great development in the use of new solvents and particularly of substitutes for ethyl alcohol raised the question whether they would be subjected to restrictions similar to those which have for so long proved so irksome in the case of ethyl alcohol and have militated against its more extensive industrial use. Fortunately, the Customs and Excise authorities preconceived ideas were influenced by the work of the legal and parliamentary committee of the Institute of Chemistry, with the result that products such as propyl alcohol, isopropyl alcohol and butanol have provisionally been placed on the duty-free list. A similar case is that of ethylene glycol, which has also been placed on the free list. Here the position is particularly interesting, because assiduous rumors have been circulated in regard to the effect of the large scale production of this material in America upon the world's glycerine market. Glycerine has always been highly speculative because one-third of the world's production is controlled by the United States and Great Britain and there have been from time to time trials of strength between the producers, and consumers such as the explosives industry, interspersed with peculiar complications due to internal competition in the explosives industry. For some time the price of glycerine has been very stable and there are even credible rumors of an international trust. The red herring drawn across the trail is now obviously ethylene glycol, the truth in regard to which has been admirably summarized by Edward R. Weidlein, Director of the Mellon Institute of Chemical Research in a letter published on May 20 in *Chemistry & Industry* (London). This statement makes it clear that the rumors regarding usage of ethylene glycol on a very large scale for the manufacture of dynamite are unfounded and although prices of glycerine have weakened slightly as a result of the rumors, there is every reason to believe that stability will be for some time a feature of this particular market.

Imperial Chemical Industries has now made the first move toward future consolidation by making an offer for the shares of the Cassel Cyanide Co., which is likely to be accepted. Rumor has it that an artificial stimulus has been given to the I. C. I. shares in order to reduce the cost of such purchases now and in future, but this idea is probably prompted to a large extent by jealousy and by the uncertainty in which other possible absorbees find themselves. The ramifications of I. C. I. are such that almost every other chemical concern of note makes definite contact, but it is generally felt that further absorption will be on a very slow and cautious scale and that a bold and independent policy on the part of outsider firms is indicated. The rumor referred to last month regarding acquisition by I. C. I. of the British interest in the International Berguis Syndicate has since been confirmed and as regards low temperature carbonization, arrangements have now been made with Sir David Milne Watson and the Gas Light & Coke Co. to form a subsidiary concern "The Fuel Production Co., Ltd.," to erect a plant with 100 tons daily capacity and to run it for three years. The plant is to be one designed by the members of the Fuel Research Board's staff, as being that most suitable for adoption in connection with the ordinary type of gas works plant. That I. C. I. is gradually tending to work more intimately in the fuel field has already been exemplified by the understanding they have arrived at with International Combustion, and the recent visit of the directors to the German I. G.'s plant at Leuna indicates that the policy successfully adopted in Germany may to a limited extent be profitably pursued in this country and in the British Dominions. Although the Bergius and kindred processes will undoubtedly have a bearing upon the future economic utilization of brown coal and lignite, its combustion in step grates and other ways continues to be practised on a large scale and the writer has recently seen an interesting rotary combustion chamber for brown coal slack, which appears to be working with great success for operating the rotary calcining furnaces which are so rapidly becoming a feature of modern chemical processes and factories. The apparatus is extraordinarily simple; the drum is rotated at about 8 r.p.m. and efficiencies of 65 per cent and over have been obtained on brown coal slack of 4,500 calories containing 38 per cent of water.

An interesting system of heating, which has recently come to the writer's notice, is the "Caliqua" process, in which hot water is circulated under pressure in a manner similar to the Frederking system, but at a much lower pressure. The inventors have hit upon the idea of circulating water direct from the boiler and at boiler pressure and after extracting from it a proportion of its heat, returning the water to the boiler. In this way, the loss of latent heat in steam traps, which is a variable quantity according to the efficiency of a factory, is eliminated. As an example, one might quote the case of a plant requiring the equivalent of 6 tons of steam per hour and in a "Caliqua" plant, the quantity of water that would be circulated at 190 deg. C. would be 70 tons per hour, the temperature in the return pipe being 150 deg. The total power required for the plant is 13 horsepower and as compared with the usual type of steam jacketed equipment with steam trap, the saving in fuel is over 23 per cent. With suitable insulation, the heat losses are only about 5 per cent and in a great many cases, it would seem that the "Caliqua" system may have a successful future. The Brunler internal combustion boiler is now being tested at the works of the Gas Light & Coke Co. and a descriptive article appeared in the *Industrial Chemist* in May.

Dupont Obtains American Rights on Casale Process

Control of the American patent rights for the production of ammonia by the Casale process has been acquired by the du Pont Company from Ammonia Casale Societe Anonyme of Basle, Switzerland, and Electric Bond and Share interests of New York. These patents have been used in this country by the Niagara Ammonia Company of Niagara Falls.

The acquisition of the patents by the du Pont Company gives it control of two important processes for the production of ammonia. Through Lazote, Inc., it already is operating a large plant near Charleston, W. Va., where ammonia is being produced by the Claude process.

The du Pont Company also has acquired the rights to the Liljenroth patents in North America, China and Japan for the production of phosphoric acid and phosphates.

Institute of Chemistry Will Bring Prominent Chemists Together

Leading Industrial Chemists from Abroad Will Attend Meeting at Pennsylvania State College in July

THE meeting of the Institute of Chemistry to be held at the Pennsylvania State College from July 4 to July 30 will be the first gathering of this sort to be held under the auspices of the American Chemical Society and according to indications will be attended by prominent industrial chemists and university men from this country and abroad. It is reported that inquiries have been received from Canada, Cuba, Porto Rico and from many of the western states.

Of the visitors from abroad Dr. Hans Tropsch will attract much interest from industrialists here. Dr. Tropsch who is assistant director of the Kaiser Wilhelm Institute for Coal Research at Mülheim-Ruhr of which Dr. Franz Fischer is the head, is expected to be

Dr. Hans Tropsch

at the Institute from July 10 to July 25 and will deliver a number of lectures on catalysis, high pressure synthesis and the production of liquid fuels, particularly motor fuels, from coal.

Another speaker will be Dr. Eric K. Rideal, Lecturer in Physical Chemistry at Cambridge University, England, who will be present from July 4 to July 15. Dr. Rideal was visiting Professor of Physical Chemistry at the University of Illinois in 1919-20, but is perhaps best known in this country as co-author with Dr. H. S. Taylor of the book, "Catalysis in Theory and Practice." He is secretary of the chemistry section of the British Association for the Advancement of Science and is vice-president of the Faraday Society.

These daily morning conferences will be a distinctive feature of the program. They will begin at eleven o'clock and the papers will be in the nature of a critical review and presentation of the recent advances in the particular subject under discussion. The papers will be followed by a discussion for which considerable time will be allowed since it is expected that the discussions will constitute a significant and valuable part of the conference. Special invitations to take part in the discussion have been sent to a number of men who have been actively working in the particular fields under consideration. The calendar for the morning conferences follows, indicating all those who had definitely accepted invitations at the time of our going to press.

Calendar of Moving Conferences

Date	Subject	Speaker
July 5	Economic Factors in Chemical Industry	John Teeple, Consulting Chemical Engineer
July 6	Ec. Factors in Indust. Research	
July 7	The Use of X-rays in Research on Structure of Non-Metallic Materials	
July 8	Modern Research on Structure of Metals	W. P. Davey, Penn. State
July 9	The Control of Corrosion (A) Protective Coatings	Wm. Blum, U. S. Bur. of Standards
July 11	The Control of Corrosion (B) New Alloys	W. B. Mitchell, Central Alloy Steel Corporation
July 12	The Training of Research Chemists	
July 13	Training of Routine Plant Chemists & Continuation Education	R. E. Rose, du Pont Co.
July 14	The General Theory of Catalysis	E. K. Rideal, Cambridge Univ.
July 15	Ammonia Synthesis	
July 16	Ammonia Oxidation	G. B. Taylor, du Pont Co.
July 18	High Pressure Synthesis	Hans Tropsch, Kaiser-Wilhelm Inst. for Coal Research
July 19	High Pressure Technique	F. A. Ernst, Fixed Nitrogen Res. Laboratory
July 20	Modern Spectrum Analysis	
July 21	Spectro Photometry	W. C. Holmes, U. S. Dept. of Agric.
July 22	Chemical Microscopy	E. M. Chamot, Cornell University
July 23	New Organic Solvents	
July 25	Determination of Particle Size	S. E. Sheppard, Eastman Kodak
July 26	Oxidation -Reduction in the Living Cell	W. M. Clark, Hygienic Lab. U. S. Pub. Health Serv.
July 27	General Status and Prob. of Nutrit.	
July 28	Vitamines	J. C. Drummond, Univers. College, London
July 29	Biochemistry	

In addition to the morning conferences there will be available some specialization on a subject of particular interest including a number of daily lectures on such subjects as catalysis, applied physical chemistry, applied mathematics, advanced organic and inorganic chemistry, colloids, biological chemistry, advanced physical measurements, etc. Many of these courses will be given by visiting lecturers, as for example, Drs. Rideal and Drummond from England, Dr. Piccard of the University of Lausanne, Switzerland, Dean James Kendall of the Graduate School, New York University, Prof. Harry N. Holmes of Oberlin College, Victor Cofman of the du Pont Company, Dr. L. H. Germer of the Bell Telephone Laboratories and Dr. L. Tonks of the General Electric Research Laboratory.

Opportunity will be given for informal contacts with fellow chemists, the chances for making new acquaintances and renewing old ones. This will be favored by the plan for having the members of the Institute and the visiting speakers live in adjacent recently constructed fraternity houses. Some of the houses will be reserved for men accompanied by their wives and others will be reserved for women members.

There will be dances for the members, golf and tennis tournaments and special arrangements will be made for picnics and excursions. In the evenings, there will be talks of a semi-popular nature on chemical subjects, and each of the foreign visitors has been invited to give one evening talk.

Dr. Eric K. Rideal

Moving pictures will be used to illustrate striking manufacturing processes and uses of chemical products.

Dean Gerald L. Wendt of Pennsylvania State College is director and chairman of the committees while Dr. A. W. Kenney of the du Pont company is executive secretary with his informational office at State College, Pennsylvania.

Imports of Synthetic Dyes Declined in May

Imports of dyes in May were smaller in volume than those reported for May, 1926. Total imports for first five months of the year also were less than in the corresponding period of last year.

Imports of Synthetic Dyes

	Lb. 1927	Lb. 1926
January	196,620	300,441
February	312,277	369,045
March	404,714	487,804
April	402,783	437,526
May	349,476	392,739
Total 5 months	1,665,870	1,987,555

Imports of coal-tar dyes for the month of May, 1927, by ports are as follows:

	Lb.	Invoice Value
New York	332,541	$253,236
Boston	13,456	10,554
Albany	3,479	1,962
Total	349,476	$265,752

U. S. Representatives Will Attend Stockholm Conference

The American delegation to the economic conference of the International Chamber of Commerce at Stockholm, June 27 to July 2, will have the benefit of the active co-operation of twenty members of the United States foreign service, who will attend the meeting as the guests of the American Section.

News in Brief

Heat Engineering Course at Carnegie—A new course in heat engineering planned to meet an increasing demand for engineers trained in conservation of fuel is to be offered at the Carnegie Institute of Technology next year, according to an announcement. The new course, it is announced, will be offered as an option in the Department of Mechanical Engineering and will be conducted under the direction of Professor W. Trinks, head of the department, and a national authority on furnace, combustion, and fuel technology problems.

Larger Production of Fuller's Earth—The fuller's earth sold or used by producers in the United States in 1926 amounted to 234,152 short tons, valued at $3,356,482, it is announced by the United States Bureau of Mines. This is an increase of 13 per cent in quantity and 15 per cent in value compared with 1925. Every important producing state except Texas showed an increase. Georgia was the leading state in production in 1926, with Florida second and Illinois third. These three states produced 82 per cent of the total output. The average value per ton of fuller's earth was $14.33 in 1926 compared with $14.15 in 1925.

New Coke Plant at Montreal—The Montreal Coke and Manufacturing Co. is constructing, on a 70-acre site adjoining the gas plant of the Montreal Light, Heat and Power Co., a modern coke and gas plant, including a battery of 59 Koppers combination coke-ovens and a by-product plant for the recovery of tar and ammonium sulphate. It is reported that this plant will have an annual capacity of approximately 350,000 tons of coke, 6,500 million cu.ft. of gas, 3,500,000 gal. of tar and 10,000,000 lb. of ammonium sulphate. The new company has also leased and will operate the Montreal Light, Heat and Power Company's gas manufacturing plant.

Lectures at Museum of the Peaceful Arts—The Museum of the Peaceful Arts, organized to establish in New York an international museum containing operating exhibits similar to that in Munich, is organizing a series of lectures and meetings in the interest of the project. On May 24 Dr. Dayton C. Miller of the Case School of Applied Science lectured on the basis of tone quality in instrumental music, after which the audience was invited to view exhibits already established at the organization's headquarters.

English Company to Produce Oil from Coal—The L. & N. Coal Distillation, Ltd., London, England, has been organized to construct and operate a plant for the production of oil from coal. The new company will take over patents and processes owned by the Sensible Heat Coal Distillation Co. It is held that under a special low temperature process of production, a ton of coal will produce 20 gals. of oil, 6,000 cu.ft. of gas suitable for domestic use, and about 14 cwt. of smokeless fuel suitable for service in the domestic grate or industrial furnace.

Soda Pulp Company Begins Operations—The Canadian Cellulose Co., Cornwall, Ont., has begun production of soda pulp in its new plant. The initial manufacture is on a basis of about 25 tons per day, the entire output being utilized at the mills of the Howard Smith Paper Mills, with which the cellulose company is affiliated. At an early date, this schedule will be advanced to more than double this amount, and a portion of the production will be placed on the open market.

Proposed Potash Plant For Texas—The Standard Potash Co., Odessa, Tex., recently formed, has taken over property about 10 miles from the town comprising extensive potash beds, and plans for the construction of a new plant. The initial project will include a group of buildings, with large refining plant. Equipment will be electrically-operated, power supply being secured from a new station now being erected at Odessa by the Texas Electric Service Co., the first unit of which is expected to be ready for operation during July.

Barium Dioxide Decision Will Be Reviewed

The United States Supreme Court on June 6 granted a petition for a writ of certiorari by which it will review the decision of the United States Court of Customs Appeals in the case of J. W. Hampton, Jr., against the government. This case involves the constitutionality of the flexible tariff, Hampton contending that the proclamation of the President increasing the duty on barium dioxide, after a report by the Tariff Commission that the rate fixed in the 1922 tariff act was insufficient to equalize cost of production here and abroad, was illegal. The Court of Customs Appeals upheld the constitutionality of the act. The case will be heard at the fall term of the court.

Celite Company Wins Patent Suit—The U. S. District Court has issued a final decree in favor of the Celite Products Co. in its suit against the Featherstone Insulation Co. The suit involved claims of infringement of patent rights of a molded diatomaceous insulating brick manufactured and sold by the Celite Products Co. of California.

Anti-Trust Charge Dismissed

The Federal Trade Commission on May 26 announced dismissal of its complaint against the Allied Chemical & Dye Corporation of New York City. The charge involved the acquisition of several chemical and dye-stuff concerns.

New Chemical Plants at Atlanta and New Orleans

Plans have been announced and construction will begin immediately on new chemical plants at Atlanta, Ga., and New Orleans, La., for the manufacture of alum and other chemicals for the paper industry. The Georgia-Louisiana Co., which has been recently incorporated in Georgia, was formed under the leadership of Robert S. Perry, consulting chemical engineer and president of Perry & Webster, Inc., of New York, and numbers among its officers and directors C. K. Williams and C. H. Knight, manufacturers, of Easton, Pa., Eli Winkler, of New York and Cincinnati, W. J. Lawrence, of Fargo, Ga., and Ralph M. Snell, of North Agawam, Mass. The individual companies thus brought together comprise a group of 21 plants in the United States and Canada, producing chemicals, rosin size, casein, clays and mineral colors, and other materials used in the pulp, paper and coating trades.

In discussing the location selected for the two new plants, Mr. R. S. Perry emphasized the fact that the raw materials, bauxite, kaolin, sulphur and naval stores are natural resources of the South. Furthermore, there is a growing market for the finished product among Southern paper manufacturers and textile mills and for the purification of municipal water supplies.

Larger Sales of Fuller's Earth in 1926

The fuller's earth sold or used by producers in the United States in 1926 amounted to 234,152 short tons, valued at $3,356,482, according to the United States Bureau of Mines. This is an increase of 13 per cent in quantity and 15 per cent in value compared with 1925. Every important producing state except Texas showed an increase. Georgia was the leading state in production in 1926, with Florida second and Illinois third. These three states produced 2 per cent of the total output. The average value per ton of fuller's earth was $14.33 in 1926 compared with $14.15 in 1925.

Fuller's earth is a term used to include a variety of natural substances that possess the property of absorbing grease or clarifying, bleaching, or filtering oil. They are mostly clay-like substances, though recently discovered material in the West, which is of different character, is said to be superior to the eastern fuller's earth. The original use of fuller's earth was in the fulling of cloth, but little of it is now used for this purpose. It is used almost exclusively in the bleaching or filtering of vegetable and mineral oils.

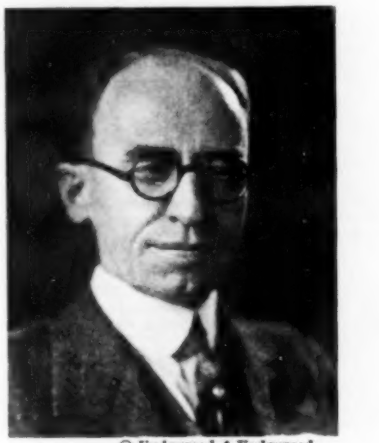
Until 1895, when fuller's earth was successfully produced commercially in Florida, the United States was entirely dependent on foreign supplies. In 1926 the imports of fuller's earth were 9,098 short tons, valued at $123,674.

The exports of fuller's earth are not separately shown but 5 producers reported that they exported 6,650 short tons, which was a slight increase over 1925.

Men You Should Know About

ERNEST E. THUM, who from 1917 to 1923 served as associate editor of *Chem. & Met.* and has since been manager of technical publicity work for the Union Carbide Co. and its subsidiaries, resigned from the latter position on June 1 to become associate editor of *Iron Age*.

Appointment of Dr. JAMES M. DORAN, a chemist, to be the head of the new bureau of prohibition is regarded by representatives of the chemical industry as being a gratifying assurance that as few burdens as possible will be laid upon the legitimate production and use of alcohol. For twenty years Dr. Doran has served the Bureau of Internal Revenue as a chemist. All the existing formulas for the denaturing of alcohol were worked out under his direction. He has made a comprehensive study of the whole subject involved in the revision of denaturing methods, practice and application. Dr. Doran was graduated from the University of Minnesota in 1907. His first job was in the laboratory of the Northern Pacific Railroad, which he left to take the position with the Internal Revenue Bureau.



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J. M. Doran

WILLIAM V. LINDER succeeds Dr. Doran as head of the technical division of the Bureau. This division has charge of the Bureau's chemical laboratory in Washington and the eighteen branch laboratories located in the various parts of the country. Mr. Linder is a native of Crawfordsville, Ind., and was graduated in chemistry from Wabash College in 1905. He took a post-graduate course at Ohio State University. Mr. Linder joined the chemical staff of the Bureau of Internal Revenue in 1907 and has been continuously engaged there since.

T. M. ANDREWS, recipient of the recently created fellowship on composite glass at the Mellon Institute of Industrial Research, Pittsburgh, Pa., is now at the institution. He was formerly connected with the research department of the A. E. Staley Co., Decatur, Ill.

JOHN J. ABEL, professor of pharmacology, Johns Hopkins University, was awarded the Willard Gibbs medal, May 27, at the University of Chicago.

W. E. PERDEW, who recently resigned as superintendent of the Derby Oil Co.'s refinery at Wichita, Kan., has become associated with the Winkler-Koch Engineering Co. of that city. The company specializes in bubble towers, tube stills and flash stills used in refinery operation.

GEORGE A. PROCHAZKA, JR., left for Europe on June 4 to be away until the end of the year. He hopes at that time to come back completely restored in health.

H. W. HARDINGE, president of The Hardinge Co., has been awarded the Edward Longstreth medal by the Franklin Institute of the State of Pennsylvania for his invention of a rotary air classifier, known as the Hardinge reverse current air classifier.

ROBERT M. CRAWFORD, formerly with The McAleenan Corporation of Pittsburgh, has severed his connection and has opened offices in the Commonwealth Building, Pittsburgh, where he will conduct a chemical and industrial engineering business for his own account, which will include engineering service or problems pertaining to low temperature carbonization of coal.

JOHN E. WIXFORD on June 1 again assumed his duties as chemical engineer for the St. Louis Water Department after a lapse of more than twenty years.

Dr. LEON S. WARE on June 1 became head of the department of chemistry at the Colorado School of Mines, Golden, to fill the vacancy caused by the resignation of Dr. Albert H. Low.

KATHERINE EVANS of Denver, Colo., is the first woman to receive a degree in chemical engineering at Denver University. The degree was granted this month.

DONALD M. LIDDELL has resigned as president of Crown Cork & Seal Co., to resume practice as consulting engineer, with headquarters in New York City. He will continue his connection with the company as consulting engineer.

SAMUEL FRANKEL has been appointed chief metallurgist of the Niagara Falls Smelting & Refining Corp., Buffalo, N.Y.

Dr. DAVID WESSON and Augusta H. Tilden were married May 18 in the Church of Our Saviour, Lebanon Springs, N. Y.

Dr. ELLWOOD HENDRICK sailed May 28 to spend the summer in South Africa.

Dr. G. L. CLARK, formerly assistant professor of chemistry in the chemical engineering department of the Massachusetts Institute of Technology, will succeed Dr. G. D. Beal next year, in the department of chemistry, University of Illinois, as associate professor.

WILBERT J. HUFF, professor of gas engineering, Johns Hopkins University, Baltimore, Md., was given the honorary degree of Doctor of Science on May 24, by the Ohio Northern University. Professor Huff was once a student at the Ohio Northern University, later attending Yale University from which he received his A.B. and Ph.D. degrees.

H. SEYMOUR COLTON has resigned as superintendent of sodium sulphydrate manufacture with Tubize Artificial Silk Co. to go with the Krebs Pigment and Chemical Co. as chemical engineer.

Dr. JOHN JOHNSTON, professor of chemistry, Yale University, has been selected to direct the new Department of Research and Technology of the United States Steel Corporation, according to the announcement of Judge E. H. Gary. The latter's statement indicated that Dr. Johnston will have an executive advisory council, one member of which will be Dr. R. A. Millikan, Norman Bridge Laboratory of Physics, Pasadena, Calif. The organization of the new department is the result of work by the research committee of the Steel Corporation, headed by George G. Crawford, president of the Tennessee Coal, Iron & Railroad Co.

John Johnston

HUBERT C. READ, who has been in the research laboratory of the Merrimac Chemical Co., Boston, is now chemist with the Atlantic Gypsum Products Co. at the Portsmouth, O., plant of the company.

A. G. DURGEN, director of the chemical department of the Spanish River Pulp & Paper Mills, Ltd., Sault Ste. Marie, Ont., has resigned to join the technical staff of the Canadian Bank of Commerce, Toronto.

H. T. BELLAMY, formerly head of the ceramic division of the Western Electric Co., Chicago, Ill., has entered business as a consulting ceramic engineer, and is connected with the Refractory Products Co. of the same city.

Prof. DUFF A. ABRAMS, heretofore director of the research laboratory of the Portland Cement Association, Chicago, is now director of research of the International Cement Corp., New York. A new laboratory will be constructed at an early date under Prof. Abrams' supervision.

W. W. EVANS, formerly with the technical division of the B. F. Goodrich Co., Akron, Ohio, is now on the technical staff of the R. T. Vanderbilt

Co., New York, manufacturers of chemicals for rubber production, compounds, etc.

W. N. WATSON was formally appointed chief of the chemical division of the U. S. Tariff Commission on June 10. Since the resignation of C. R. DeLong, six months ago, Mr. Watson has been acting chief of the chemical division, with which he has served eight years. Mr. Watson is a native of Auburn, Maine, and was educated at Massachusetts Institute of Technology and Harvard University. He formerly was an instructor in chemistry at Bates College and later at Brown University. Before entering the Government service he served as chief chemist of the Arnold Print Works at North Adams, Mass., and as chief chemist of the Lewiston Bleaching and Dye Works.

W. J. WEBSTER, president of the Atlas Powder Co., Wilmington, Del., since its formation in 1912, has resigned that office to become chairman of the board of directors of the company. He will be succeeded as president by Leland Lyon, who has been secretary and treasurer of the company for a number of years.

Dr. HELMUTH FRED MANSKE, Manchester University, England, has been awarded the Lilly Research Fellowship in organic chemistry at Yale University, and will engage in this line at the institution under Prof. T. B. Johnson. This is the first award of the fellowship, which carries a stipend of $3,000.

D. A. MILLER, consulting chemical engineer for the textile industry, and connected with John H. Haerry & Associates, Palisade, N. J., chemical engineers, has left for Mexico, where he will remain for an indefinite period. He will supervise the construction of a new bleach, dye and finishing plant while in that country.

DANIEL J. REAGAN, who has been serving as a trade commissioner in Paris specially assigned to chemical matters, has been promoted to the position of assistant commercial attache in the Paris office of the Department of Commerce.

JOHN P. GREGG, private secretary to Secretary Hoover, has resigned to become manager of the International Chamber of Commerce. He will attend the forthcoming general conference of that organization at Stockholm.

Obituary

RAY POTTER PERRY who died May 29 at his home in Montclair, N. J., was for more than 20 years in the service of the Barrett Co., first under his father at Cleveland, later in New York as manufacturing manager and finally as vice-president and assistant general manager of the company. Leaving this organization five years ago, he took up an intensive course at New Brunswick in fruit raising and market gardening. This leisure also gave him an opportunity to take a very sincere interest in educational and religious activities in Montclair. In February, 1925, he was appointed a member of the Board of Education and gave to this work an unstinted measure of his time and energy. Mr. Perry was a graduate of Harvard and until his retirement from business was active in the technical societies and chemical trade assocations.

EDWIN WORTHING HALE died at the Hotel Gotham, New York, on May 22, at the age of 50. Mr. Hale's home was in Cleveland where he attended the University School from its founding in 1890 to 1896, and the Case School of Applied Science where he took a special course in chemistry and metallurgy in 1900. During the War he was associated with Dr. C. G. Fink at the Chile Exploration Company laboratory carrying out researches on the metallurgy of zinc and tin. After the war, in 1922, he came to Columbia University as assistant in metallurgy in the School of Mines, which position he held at the time of his death.

CHARLES L. PARMELEE, prominent consulting engineer to the petroleum industry, died at his home in West Orange, N. J., on April 4, 1927. Mr. Parmelee, who was 54 years of age at the time of his death, had been actively engaged in technical work until taken ill in February and for two months had been confined to his home.

Industrial Notes

THE FULLER LEHIGH CO. announces that it has taken over that portion of the business of the Bailey Meter Company pertaining to pulverized coal feeders, burners and water cooled furnace walls.

THE FOOTE BROS. GEAR AND MACHINE CO., Chicago, announces the appointment to the sales force of E. H. Sager, formerly Chicago representative for the Ajax Flexible Coupling Co., who is assigned to the territory in the State of Michigan.

THE CHAIN BELT CO. of Milwaukee, Wis., has recently opened an office in Birmingham, at 720 Brown Marx Building, to handle the sale of Rex chain and conveying systems in the State of Alabama. S. L. Morrow is in charge of the new office.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., is celebrating the 100th anniversary of its establishment. The company has commemorated its history and achievements in a brochure entitled "A Tale of Yesterday, Today and Tomorrow," by Floyd W. Parsons. The story recites in an inspirational way the achievements and tribulations of the organization and its form of business philosophy that has guided the company through 100 years of service.

JOHN C. CAMPBELL, President of the Newark Wire Cloth Co., Newark, N. J., completed his fiftieth consecutive year as a manufacturer of wire cloth on April 2, 1927. Approximately sixteen years of that period have been spent with his present company. When his first factory was ready to operate it consisted of only three old-fashioned hand looms, but these have been superseded by new and improved automatic machinery. The present plant in Newark has sufficient floor space to house under one roof the entire equipment of the former plant of seven buildings together with the plant of the Morse-Whyte Co. of Cambridge, Mass., purchased in 1923. Under Mr. Campbell's direction his company has produced not only wire cloth of all sizes but special designs of metallic filter cloth. The company was first to adopt the Bureau of Standards' specifications for testing sieves.

THE INDUSTRIAL CHEMICAL CO., New York, announces the appointment of John P. Harris, as manager of its Chicago office at 400 North Michigan Ave.

THE HEVI DUTY ELECTRIC CO., Milwaukee, Wis., has appointed the S. D. Thomas Co., 521 Arch Street, Philadelphia, Pa., as a sales representative in the Philadelphia territory, comprising the eastern half of Pennsylvania, southern half of New Jersey and the States of Delaware, Maryland and the District of Columbia. The Beeman Equipment Co., 458 Twenty-first St., Detroit, Mich., has also been appointed a sales representative.

THE FALK CORPORATION of Milwaukee, Wis., manufacturers of herringbone gears, speed reducers, steel castings, Diesel engines and flexible couplings, has opened an office in Chicago at 122 South Michigan Avenue, with C. H. Thomas in charge.

THE C. O. BARTLETT & SNOW COMPANY, Cleveland, Ohio, has opened a sales office at 406 Bessemer Building, Pittsburgh, Pa. W. C. Schade has been appointed manager of the new office.

THE ALSOP ENGINEERING CO., makers of Hy-speed machines, has taken over an entire floor of the Hartford Building at Broadway and Sixty-third Street, New York City, for sales offices, display rooms and the shipment of special orders.

FOOTE BROS. GEAR & MACHINE CO., Chicago, Ill., has appointed E. L. Parsons, formerly district manager for the Ramsey Chain Company of Boston, as district representative for the State of Wisconsin and northern Illinois, with headquarters at 49 E. Wells St., Milwaukee.

ANDREWS-BRADSHAW COMPANY, Pittsburgh, Pa., manufacturers of the Tracyfier, announces the addition to its personnel of R. N. Robertson, as chief engineer, and A. L. Menzin, as director of research.

THE COMBUSTION ENGINEERING CORP., Raymond Bros. Impact Pulverizer Co., Ladd Water Tube Boiler Co. and Heine Boiler Co., all subsidiaries of the International Combustion Engineering Corp., have appointed William B. Senseman Pacific Coast District Manager, with offices at 417 South Hill St., Los Angeles, Calif.

THE ARMSTRONG CORK & INSULATION CO., Pittsburgh, Pa., announces that the New York office is now located at 255 Broadway and the Tulsa, Okla., office at 419 Central National Bank Building.

BAILEY METER CO., Cleveland, Ohio, announces the appointment of E. W. Fitch as manager of its St. Louis office located at 1808 Railway Exchange Building.

FOX BROTHERS INTERNATIONAL CORPORATION, a subsidiary of the exporting firm of Fox Bros. & Co., 126 Lafayette St., New York, announces that it has made arrangements with banking interests in New York and London which will insure a credit against acceptance documents on Russian purchases to the amount of $5,000,000 for the current year. Under this arrangement American exporters will be paid in cash for Russian purchases. It is stated that the corporation was formed to facilitate purchases of engineering equipment and offer things of which the Soviet government is in urgent need in the American market. Under existing economic and industrial conditions the Russian government cannot pay cash for its requirements and American manufacturers do not feel warranted in extending the long-term credits that are necessary. John J. Teal, vice-president of the corporation, says there is a strong sentiment in Russia for goods of American manufacture, especially in lines of mechanical equipment.

Calendar

AMERICAN CHEMICAL SOCIETY, Detroit, Mich., Sept. 5 to 10.

AMERICAN ELECTROCHEMICAL SOCIETY, Northwestern trip, visiting industrial plants at Minneapolis, Butte, Anaconda, Wallace, Kellogg, Spokane, Seattle, Vancouver, Great Falls, Omaha and Keokuk, Sept. 4-20.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, St. Louis, Mo., Dec. 5-8.

AMERICAN LEATHER CHEMISTS ASSN., annual meeting, Cincinnati, Ohio, June 15, 16 and 17.

AMERICAN OIL CHEMISTS' SOCIETY, New Orleans, June 20-21.

AMERICAN SOCIETY FOR STEEL TREATING (ninth annual convention and exposition), Detroit, Sept. 19-24.

AMERICAN SOCIETY FOR TESTING MATERIALS, French Lick, Ind., June 20 to 24.

NATIONAL COLLOID SYMPOSIUM, Ann Arbor, Mich., June 22 to 24.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, (11th) Grand Central Palace, New York, Sept. 26-Oct. 1.

NATIONAL SYMPOSIUM ON GENERAL ORGANIC CHEMISTRY (second) Ohio State University, Columbus, Ohio, Dec. 29-31.

Market Conditions and Price Trends

Larger Production of Carbon Black Reported for 1926

Falling Off in Demand from Rubber and Export Trades Caused Decline in Volume of Sales

PRODUCTION of carbon black from natural gas in 1926 was 180,576,176 lb., valued at the plants at $9,939,221, according to G. R. Hopkins, of the United States Bureau of Mines. This represents an increase in production over 1925 of 3,158,798 lb., or 2 per cent, which was, however, insufficient to eclipse the record figure of 186,872,034 lb. established in 1924. Stocks at the plants December 31, 1926, amounted to 108,378,101 lb., an increase of 12,354,653 lb., or 13 per cent, over the preceding year. Losses at the plants in 1926 totaled a little over 700,000 lb. or about half what they were in 1925.

The production minus the addition to stocks and the losses gives total deliveries or sales for 1926 as 167,504,710 lb. as compared with 175,631,326 lb. in 1925, a decrease of 8,126,616 lb., or 5 per cent. This is the first time since carbon black statistics have been compiled that total sales have shown a decrease.

The distribution of carbon black deliveries among industries in 1925, as determined by a survey recently completed, was as follows:

Distribution of Carbon-Black Deliveries in 1925

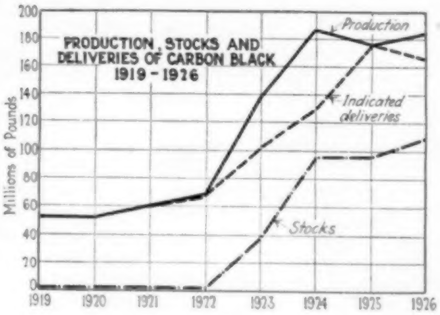
	Lb.
Rubber	86,329,000
Export	43,183,000
Ink	22,389,000
Paint	11,757,000
Miscellaneous	11,973,000
	175,631,000

Production, stocks, and indicated deliveries of carbon black, 1919-1926, are shown as follows:

Production, Stocks and Deliveries of Carbon Black

	Production, Lb.	Stocks, End of Period, Lb.	Indicated Deliveries, Lb.
1919	52,057,000	2,000,000	52,057,000
1920	51,322,000	2,000,000	51,322,000
1921	59,766,000	2,000,000	59,766,000
1922	67,795,000	2,435,000	67,360,000
1923	138,263,000	38,321,000	102,211,000
1924	186,872,000	95,671,000	128,861,000
1925	177,417,000	96,023,000	175,631,000
1926	180,576,000	108,378,000	167,504,000

These figures prove that carbon black finds its chief use as a filler in rubber, its finely divided state greatly reducing oxidation and increasing the tensile strength. About two-thirds of the total output of carbon black is eventually used in rubber. Carbon black is not considered as indispensable in rubber as in printing ink, and in times of high prices it has often been supplanted by zinc oxide or graphite. However, it is at present of great importance to the tire trade, which uses roughly 85 per cent of all the rubber consumed in this country. The modern automobile tire, deep black in color and with great resistance to abrasion, is a vast improvement over the tire of twenty years ago, which was built on the lines of the present-day inner-tube. Although the greater part of the improvement in quality of tires has been due to better manufacturing methods, some part of the advance can be credited to the use



of carbon black, which comprises about 10 per cent of the weight of the average tire.

Though similar data for 1926 are not available, except for exports, it is probable that the amounts used in the ink, paint, and miscellaneous trades were practically unchanged, the major portion of the decline in total sales being chargeable to exports and to the big consumer, the rubber industry.

Technical advances and the willingness of the carbon black manufacturers to co-operate in the interest of conservation enabled the industry to produce more carbon black from less gas in 1926. The estimated quantity of natural gas used in 1926 to produce carbon black was 130,321,000 M cu.ft. This indicates an average yield of 1.4 lb. per 1,000 cu.ft. of gas, an increase of 0.1 lb. over 1925 and the highest yield ever recorded.

Louisiana Largest Producer

Louisiana remained the outstanding producing state, its output in 1926 of over 130,000,000 lb. comprising 72 per cent of the total for the country. West Virginia produced 3,804,586 lb. This state, once the leader in the industry, is now producing only 15 per cent of its output of six years ago and only 2 per cent of the output of the country. Texas showed the greatest gain in production of any of the states, its output amounting to 36,328,052 lb. as against 26,219,510 lb. in 1925, a gain of 39 per cent. Three new plants began operations in Texas in 1926.

The channel process remained by far the most important method of manufacturing carbon black, producing 152,300,410 lb. in 1926 as compared with 28,275,766 lb. by the other processes. A new process known as the "Barbour" process has been tested and superiority for it is claimed on the ground that it will greatly increase the carbon black yield per unit of natural gas consumed.

The carbon black industry if it remains dependent on natural gas will probably always be a nomadic westward-moving industry. But there is much unutilized gas in Texas and the Rocky Mountain district.

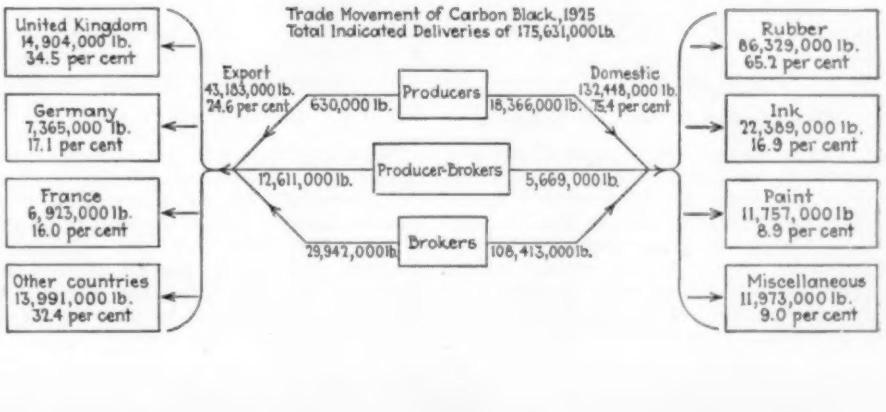
Exports of carbon black in 1926 amounted to 39,210,389 lb. as compared with 43,182,635 lb. in 1925. The 1926 exports had an average value of 9.2c. as compared with 8.2c. in 1925. The United Kingdom was our leading carbon black customer in 1926, followed in order by France, Canada, and Germany. Of these four countries France showed the greatest increase over 1925.

The rapid increase in export trade in carbon black is shown in the following table:

Exports of Carbon Black

	Lb.	Value	Average Price per Lb.
1922	15,000,000	$1,750,000	$0.117
1923	27,000,000	4,400,000	.163
1924	32,500,000	3,200,000	.098
1925	43,183,000	3,556,000	.082
1926	39,210,000	3,622,000	.092

Domestic and Foreign Distribution of Carbon Black in 1925



Market Conditions and Price Trends

Recession in Consuming Demand for Chemical Products

Seasonal Conditions Bring About Moderate Declines in Production and Distribution of Different Selections

WHILE demand for some chemicals has been stimulated by seasonal conditions, in other cases operations on the part of both producing and consuming industries, have been on a less active scale and trade opinions credit a decline in chemical production in May as compared with that for the preceding month. The fertilizer industry reported a decline of 5 per cent in fertilizer sales in May as compared with May, 1926 and for the six months of the fertilizer season, December-May, sales were 15 per cent less than for the corresponding period of last season. This condition would have an almost direct reference to consumption of sulphuric acid, nitrate of soda, potash salts, and other fertilizer chemicals, within that industry. It is possible that consumption of sulphuric acid in other industries was larger than a year ago but it is certain that production and consumption of this acid has fallen below the totals reported for 1926.

Indexes of Employment

Consumption of chemicals in April was smaller than it was in March if the weighted indexes of employment of the Bureau of Labor may be taken as a basis of calculation. These indexes indicate reduced activities in the leather, paper and pulp, chemical, oil refining, and glass industries. The indexes compare as follows:

Weighted Index of Employment

	April 1927	March 1927	April 1926
Dyeing and finishing textiles	101.1	100.0	99.7
Leather	88.8	92.9	91.1
Paper and pulp	94.2	94.3	96.1
Chemicals	96.7	96.9	95.7
Fertilizers	142.3	134.6	137.5
Petroleum refining	100.3	103.0	98.9
Glass	96.4	96.6	100.0
Automobile tires	111.8	105.9	111.6

The employment figures are borne by reports on specified materials for which definite figures are available. For instance production of chemical wood pulp was reported at 215,240 tons for April as compared with 225,664 tons for March, and 231,432 tons for April, 1926. Total paper production, including newsprint, was 678,545 tons in April, 700,960 tons for March, and 724,186 tons for April, 1925. Production of explosives was 31,962,000 lb. in April, 34,186,000 lb. in March, and 32,190,000 lb. in April, 1926.

Raw Materials Output Smaller

According to compilations of the Department of Commerce the output of raw materials in April was smaller than in March but larger than a year ago, increases being registered over last year in all groups except forest products, which declined. Manufacturing production, after adjustments for differences in working time, showed no change from the preceding month but was greater than a year ago. All industrial groups, with no allowance for working time differences, showed smaller quantitative output than in March, except stone and clay products and automobiles, which increased. As compared with a year ago, production in all industrial groups was greater, except iron and steel, nonferrous metals, lumber, paper and printing and automobiles, which declined.

Stocks of commodities held at the end of April, after adjustments for seasonal variations, were smaller than at the end of the previous month but greater than a year ago. All commodity groups showed declines from the preceding month except manufactured foodstuffs, which increased. As compared with April, 1926, all commodity groups showed increases, except manufactured foodstuffs, which declined.

Unfilled orders for manufactured commodities, principally iron and steel and building materials, showed no change from the preceding month but were smaller than a year ago. As compared with both the previous month and April a year ago, unfilled orders for iron and steel were smaller, while building materials increased.

With reference to basic commodities, declining productions are reported for steel, pig iron, and coal. The Department of Agriculture also states that agriculture has suffered many set-backs the last two months which have reversed completely the prospects for an early season at the beginning of the crop year. Spring planting throughout the North has been delayed probably two weeks later than average. The Mississippi flood has inundated more than 3,000,000 acres of crop land in five States. The Southeast and a portion of the Southwest has suffered from drought. Eastern pastures and western ranges alike have been slow to furnish spring feed, though the abundant moisture promises an ample grass crop for summer. The Mississippi flood situation is summarized mainly as affecting the production of long staple cotton. The heart of the long staple producing area of the United States is in the flooded area, embracing somewhat over 30 per cent of the long staple cotton acreage in the United States.

Lower Price Trend

Weighing the different price changes which have been made in the market for chemicals in the last month, it is found that the index number for June was below that for the preceding month. The alcohol market showed the greatest change with sharp upward revisions for ethyl alcohol and breaks in values for methyl alcohol. The weighted index number for chemicals closed at 112.83 which compares with 112.95 for May and 113.67 for June, 1926.

Oils and fats, on the other hand, showed a higher average level for the month. This was due to firmer markets for linseed and cottonseed oils as well as tallow. In the case of cottonseed oil, however, the strength in values was apparent more in crude than in the refined product. The crushing season is practically over and stocks of crude oil are in firm hands whereas refined oil failed to hold advances and in spite of large disappearances each month, the visible supply remains as a check to advancing values. The index number for oils and fats is 130.07 as contrasted with 129.97 for May, and 169.79 for June, 1927.

Foreign Trade

Export trade in chemicals and allied products in April was larger than in April 1926 with outward shipments valued at $12,275,909 and $11,783,471 respectively. Coal-tar products played an important part in this increase with large shipments of benzol, crude coal-tar, and coal-tar pitch. Slight increases were recorded in exports of potassium and sodium salts.

Imports of chemicals in April were valued at $11,379,788 as compared with $13,688,503 for April, 1926. Among the coal-tars increases were reported in arrivals of intermediates and dyes. Among industrial groups, marked declines were noted in imports of sulphuric acid, barium compounds, and nitrate and nitrite of soda. Larger imports were reported for arsenic, tartaric acid, and caustic potash.

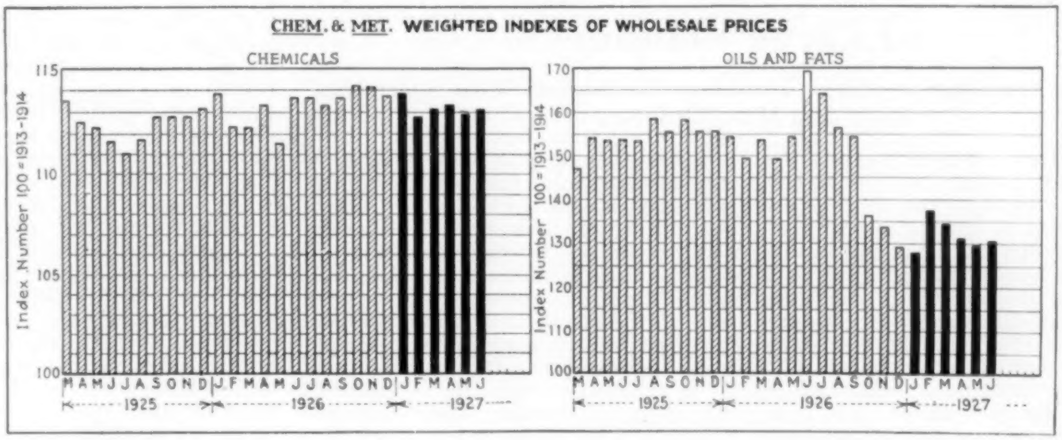
Nearly all classes in the naval stores category recorded increases in the current April over April, 1926, in both quantities and values, with totals for the month equalling $2,243,400. Of the shipments of 88,950 barrels of rosin worth $1,672,000, Germany took one fourth, England, one seventh, and Brazil, one eighth. Wood rosin accounted for 12,500 barrels, $181,100. Germany, Netherlands, England, and Canada, were the largest customers for the 572,900 gallons worth $413,000 of gum spirits of turpentine shipped in April, 1927.

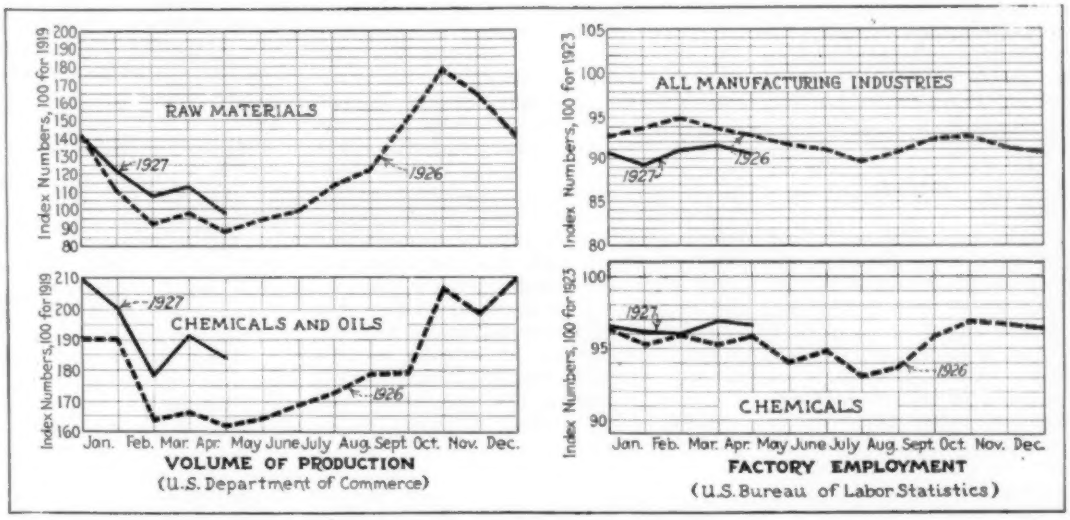
The falling off in receipts of varnish gums is largely responsible for the 36 per cent decline to $2,244,000 worth in incoming shipments of gums and resins which important group comprised one-eighth of the total chemical imports. The $1,070,000 (5,777,000 pounds) of varnish gums imported in April, 1927, represented declines of one-third in values and one-fourth in quantities. Shellac fell from $938,300 (2,341,000 lb.) in April, 1926, to $526,600 (1,361,000 lb.) in April, 1927.

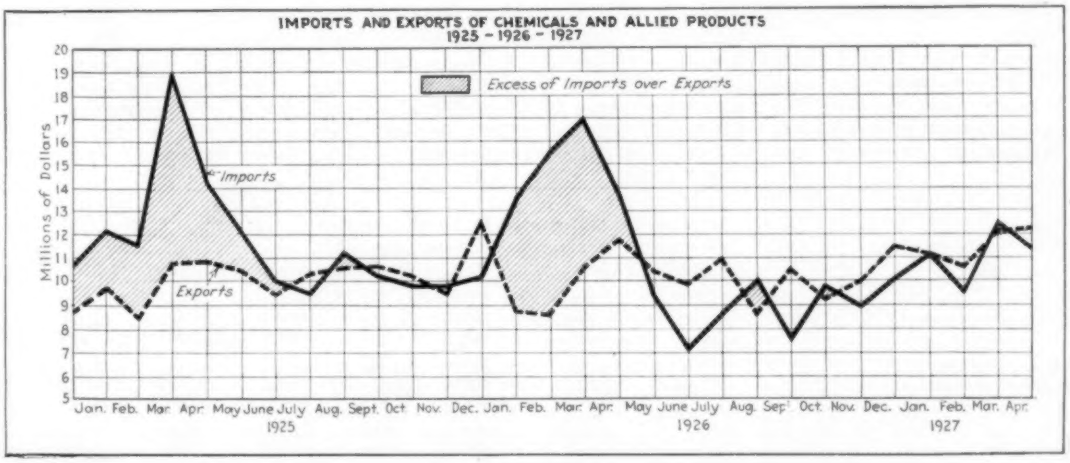
The most noticeable changes in imports were appreciable reductions in crude glycerin and iodine which had been arriving in large volume.

CHEM·& MET· Statistics of Business

In the Chemical Engineering Industries







Market Conditions and Price Trends

Contract Deliveries of Chemicals of Large Volume

Trading in Spot Market Shows Tendency To Decline With Specialties Receiving Most Attention

CONSUMING requirements for chemicals appear to be largely covered by contracts and new orders are reported to be coming on the market in a limited way. This may be accounted for by the fact that buyers were active during the contracting season and manufacturers are using a large part of their production to take care of existing orders. Seasonal buying for some selections has been in evidence in the spot market but, generally considered, spot trading has been moderate and is expected to show but little activity in the next two months. The position of consuming industries is not such as to encourage hopes that they will enlarge commitments for chemicals or other raw materials.

With new business light, producers are competing to work off surplus production and an easy tone has been maintained with reference to market values. The average level of prices declined slightly during the month although no open change was made in quotations for the majority of important selections.

Prices for oils and fats were increased somewhat during the interval although there were no changes in basic conditions which would warrant any radical price movements. China wood oil, perhaps, is in the most sensitive position as values are rendered uncertain because it is difficult to form a definite opinion regarding future shipments from primary markets. In this connection it is worthy of note that the first crop from domestic tung trees will be harvested next Fall.

The position of wood chemicals has not been helped by the pressure in the market of a new producer of synthetic methanol. Export trade in acetate of lime and formaldehyde also has been running behind that for the corresponding period of 1926.

Arsenic production has been considerably above that of last year and imports have more than doubled for the year to date. However, stocks are large and consumption evidently has not been keeping pace with production and importations. Late season buying may help matters as boll weevil emergence has been larger than last year and the outlook is regarded as favorable for arsenic and calcium arsenate. So far there has been no heavy buying of arsenate and asking prices have not varied much but advancing prices are probable if demand opens up in an active way.

Important chemicals offer competition with many domestic selections but reference to import figures shows that foreign nitrite of soda has become less of a factor in our markets and the fact that domestic sellers booked a large part of the consuming trades on contracts has made it difficult to dispose of round lots in the spot market even at price concessions. So far this year foreign-made salammoniac has been imported in large amounts but domestic sellers have been meeting competition in the last month and the effect of this may show up in future shipments of the foreign product.

Recent advices from Chile stated that production of nitrate of soda had been increased and this was regarded as a sign of improvement in the industry. The falling off of 15 per cent in sales of fertilizer naturally has cut down consumption of nitrate in this country but the reduction in imports in recent months has cut down spot supplies and created a firmer price situation.

Larger Production of Naval Stores This Season

The production of turpentine during the present season is expected to be considerably greater than in recent years, judging from the number of new turpentine cups sold during the past winter. According to data compiled by the office of Naval Stores Investigations, Bureau of Chemistry, sales of cups, including all types, amounted to a total of 32,310,000, equivalent to 3,231 crops of 10,000 cups each. This is an increase of 57 per cent over the number sold for last season which amounted to 20,500,000, equivalent to 2,050 crops.

For the season 1925-1926 only 10,059,000 news cups, equivalent to 1,006 crops, were sold, the smallest number sold since the bureau begain compiling these data. For 1924-25 there were 13,249,000 cups sold, and for the preceding season 24,828,500 cups were produced and sold to turpentine operators.

Records of receipts of turpentine and rosin since the beginning of the crop year bear out the belief that the increased sale of cups meant a larger production of naval stores this season. Arrivals of turpentine and rosin at primary distribution points were much larger in April than in the corresponding period of 1926. The course of market prices also has indicated that the new supply would be of ample size and reports from the London market indicate that sales have been made abroad at sacrifice prices influenced by the large stocks on hand and the probability of large offerings for shipment. The statistical position of naval stores is shown in the accompanying table.

High Prices Maintained for China Wood Oil

Although the unusually high prices for China wood oil which were established in April have given way to levels more in buyers' favor, the basis of sales still holds considerably above normal levels. The supply of wood oil in China is reported to be large and the disturbing factor is found in the uncertainty of making shipments, especially from interior points to the ports. There has been no scarcity of oil in this country as may be seen from the fact that stocks on hand March 31, either in sellers' or consumers' hands, amounted to 13,841,771 lb. Import statistics also prove that arrivals from Chinese ports have been of normal volume. Imports for the first four months of the year were 28,523,073 lb. as compared with importations of 29,087,920 lb. for the corresponding period of last year.

Recent cable advices to the Department of Commerce have touched on conditions as they exist in China and have failed to bring assurance that

Production and Stocks in Naval Stores

	1926				1927			
	Jan.	Feb.	March	April	Jan.	Feb.	March	April
Turpentine (gum)...								
Receipts at southern ports, bbl.	6,512	4,681	3,499	11,291	7,386	5,138	10,132	30,989
Stocks, end of month, at five ports, bbl.	54,304	46,719	30,470	27,414	53,098	42,806	21,871	33,241
At stills, bbl.	8,749	4,807	6,064	4,821	8,794	5,035	3,188	7,432
Rosin (gum)								
Receipts at southern ports, bbl.	36,466	31,082	20,196	40,643	39,136	27,214	36,322	97,028
Stocks, end of month at five ports, bbl.	218,726	196,157	137,263	107,961	179,943	166,323	77,848	123,412
At stills, bbl.	93,318	78,704	58,846	40,813	84,261	74,774	58,431	58,910
Turpentine (wood)								
Production, bbl.	4,362	3,930	4,934	4,595	7,053	6,587	7,253	......
Stocks, endof month, bbl.	3,468	2,670	2,706	2,785	5,531	7,314	4,096	......
Rosin (wood)								
Production, bbl.	20,470	18,945	24,145	22,920	35,168	32,043	35,313	......
Stocks, end of month	16,431	17,630	21,699	27,963	33,513	45,124	31,250	......
Pine Oil								
Production, bbl.	135,135	125,247	173,465	158,149	241,563	207,197	245,232	......
Stocks, end of month, bbl.	674,097	645,441	598,459	565,416	305,151	313,457	268,344	......

Market Conditions and Price Trends

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**112.83**
Last month	112.95
June, 1926	113.67
June, 1925	111.76

Numerous price changes have occurred in the chemical list during the month. Spot nitrate of soda has been firmer and the same was true for anyhydrous ammonia. Higher prices were asked for citric acid and alcohol but lower prices ruled for methanol, lead oxides, sulphate of ammonia and some of the coal-tars.

regular shipments may be looked for in the immediate future.

One cable stated that shippers of wood oil in Hongkong estimate the maximum shipments of wood oil from that port will not exceed 1,500 tons monthly during May and June. The available spot stocks of export grade total 100 tons but there are large stocks of inferior oil unsuited for export. Wood oil is moving freely from the West River but the amount routed by way of Hongkong which normally would be exported through Hankow is but a few hundred tons of low grade oil.

The wood oil exports from Hongkong to the United States for the month of April totaled 2,916,000 lb. This amount is far in excess of the previous month when shipments from this port to the United States amounted to 887,200 lb.

Unsold stocks of wood oil in Shanghai, China, amount to 300 tons and stocks at Hankow are 200 tons. It is reported that large stocks of wood oil have accumulated at Wanhsien but that transportation facilities are so poor as to make future developments uncertain. Trade in wood oil has been greatly restricted during a recent period because of the money situation. Remittances are extremely difficult and in many cases impossible. Transportation from up river is by junk only and movement is hampered.

The following table shows the amounts of wood oil imported into the United States for the first four months of 1927 and for the corresponding period of 1926:

	1926 Lb.	1927 Lb.
January	11,111,773	5,173,024
February	6,362,973	4,939,993
March	6,279,689	7,401,381
April	5,333,485	11,008,675
Total	29,087,920	28,523,073

Increase in Offerings Weakens Prices for Methanol

When German producers of synthetic methanol first began to solicit orders from American buyers the status of domestic producers of the wood distillation product was placed in a dubious position. A new process involving lower production costs loomed up not alone as a formidable competitor but as a possible destroyer of a century-old industry. Early apprehensions were somewhat allayed when it was seen that German producers did not have a surplus large enough to take care of more than a small percentage of American consuming requirements. The invocation of protective tariff duties also proved to be a defensive asset for domestic producers. The real threat behind the commercial development of synthetic methanol, however, lay in the certainty that, sooner or later, its production would be undertaken in this country. In the early part of the year domestic production was started on a commercial scale and in the last month a second domestic producer entered the field and began to offer this material in large volume. This has brought producers of the wood distillation product in direct competition with domestic producers of synthetic methanol and without any compensating price differential as represented by an import duty. Sellers of German-made synthetic methanol also have been offering at low prices duty paid and the keen competition which resulted has brought about a drastic downward revision of sales prices. Early in June an open reduction of 17c per gal. was announced by prominent sellers of wood distillation methanol and the lowering in price merely meant the placing of prices on a parity with those which were in effect for synthetic methanol whether of foreign or domestic origin.

While the lower-priced schedules may be due in part to competitive selling it is undoubtedly true that, in the case of synthetic methanol at least, the revision followed a lowering in producing costs. If the newly established prices represent a fair margin of profit, it is improbable that higher prices will be attained and makers of wood distillation methanol will be in a position of disadvantage. There always has been uncertainty about costs of producing synthetic methanol in Germany and it will be interesting to see how much of a factor in our future market the German product will be. One of the largest buyers of German methanol is now a producer, or at least controls a domestic production, and as heretofore, a large part of importations have been delivered against contracts, it is probable that German methanol must compete more in the open market if it is to hold its percentage of domestic business.

Increased production of synthetic methanol also must be considered as a possible factor in cutting down sales of wood methanol for export. This already has been shown in our foreign trade with some countries. For instance in 1924 Japan imported 11,760 piculs of methanol from the United States, and only 64 piculs from Germany, a picul equalling 133⅓ lb. In 1925 imports were 6244 piculs from the United States and 742 piculs from Germany. In 1926 imports were 3755 piculs from the United States and 4895 piculs from Germany.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**130.07**
Last month	129.97
June, 1926	169.79
June, 1925	153.87

Higher prices for linseed and cottonseed oils were largely counteracted by the lower market for china wood oil, glycerine, and peanut oil. The weighted index, however, was advanced slightly but is materially below that for June, 1926.

In contrast with the lower market for methanol, advances have been made in sales prices for denatured alcohol. The molasses market has been firm and resale lots have been well absorbed so basic conditions have warranted higher prices. Buying for anti-freeze purposes already has been in evidence and with future consumption expected to increase producers and sellers are not willing to quote on distant deliveries and are confining sales to nearby positions with confidence that the trend of values will be upward as the season progresses.

Imports of Chemicals

	April 1927	April 1926
Dead or creosote oil, gal	7,892,665	10,025,408
Pyridine, lb	33,058	125,728
Coal-tar acids, lb	3,160	34,461
Coal-tar intermediates, lb	218,854	33,543
Arsenic, lb	2,556,143	866,454
Acid, citric, lb	23,632	30,016
Acid, formic, lb	153,136	224,059
Acid, oxalic, lb	123,098	102,802
Acid sulphuric, lb	4,489,961	7,100,590
Acid, tartaric, lb	268,373	57,008
Ammonium chloride, lb	1,638,424	1,397,996
Ammonium nitrate, lb	267,308	574,193
Barium compounds, lb	971,122	2,740,948
Calcium carbide, lb	343,600	610,945
Cobalt oxide, lb	16,800	24,500
Copper sulphate, lb	67,318	154,103
Bleaching powder, lb	224,150	210,487
Lime, citrate, lb	110,638	222,718
Glycerin, crude, lb	521,513	1,537,209
Glycerin, refined, lb	405,536	527,942
Magnesium compounds, lb	38,886	65,319
Potassium cyanide, lb	8,220	1,844
Potassium carbonate, lb	1,650,787	1,174,883
Potassium nitrate, ton	79	....
Caustic potash, lb	1,193,292	675,592
Cream of tartar, lb	10	....
Potassium chlorate, lb	1,569,567	893,745
Sodium cyanide, lb	4,298,904	3,398,054
Sodium ferrocyanide, lb	240,818	51,174
Sodium nitrite, lb	39,087	345,164
Sodium nitrate, ton	97,480	124,370
Sulphate of ammonia, ton	431	345

Exports of Chemicals

	April 1927	April 1926
Benzol, gal	3,386,722	2,408,518
Crude coal-tar and pitch, bbl.	112,174	14,794
Acid sulphuric, lb	1,024,337	1,029,287
Other acids, lb	826,029	1,479,151
Methanol, gal	41,254	26,794
Ammonia and compounds, lb.	407,337	449,927
Aluminum sulphate, lb	3,414,363	2,758,289
Acetate of lime, lb	974,301	503,472
Calcium carbide, lb	453,227	476,957
Bleaching powder, lb	1,210,814	1,808,688
Copper sulphate, lb	449,889	510,931
Formaldehyde, lb	93,287	215,420
Potassium compounds, lb	258,127	140,879
Sodium bichromate, lb	839,345	580,539
Sodium cyanide, lb	62,609	284,023
Borax, lb	5,184,883	3,228,240
Soda ash, lb	3,734,791	3,546,129
Sodium silicate, lb	4,132,090	4,581,058
Sal soda, lb	1,122,946	817,680
Caustic soda, lb	6,560,265	8,014,201
Bicarbonate of soda, lb	1,230,316	1,871,433
Sulphate of ammonia, ton	7,794	11,054
Sulphur, ton	40,565	42,009

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to June 13.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.38 - 3.63	3.38 - 3.63	3.25 - 3.50
Boric, bbl	lb.	.08½- .08¾	.08½- .08¾	.08½- .11
Citric, kegs	lb.	.44¼- .45	.43½- .47	.45 - .47
Formic, bbl.	lb.	.10½- .11	.10½- .11	.10½- .11
Gallic, tech., bbl	lb.	.50 - .55	.50 - .55	.45 - .50
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.13½- .14
22%, tech., light, bbl.	lb.	.06½- .07	.06½- .07	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	cwt.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.10½- .11
Phosphoric, tech., c'bys.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Sulphuric, 60°, tanks	ton	10.50 -11.00	10.50 -11.00	10.50 -11.00
Tannic, tech., bbl	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl	lb.	.34 - .35	.33 - .34	.29 - .30
Tungstic, bbl	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f. U.S.P. bbl	gal.	4.92½- 5.00	4.92½- 5.00	4.90 - 5.00
Alcohol, Butyl, dr	lb.	.19½- .20½	.20 - .20½	.18½- .19
Denatured, 190 proof				
No. 1 special dr	gal.	.45½-......	.37½- .39½	.28 -......
No. 5, 188 proof, dr.	gal.	.43 -......	.37½- .39½	.28 - .32
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl	lb.	.02¾- .03½	.02¾- .03½	.02¾- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg	cwt.	2.00 - 2.10	2.00 - 2.10	2.40 - 2.45
Aqua ammonia, 26°, drums.	lb.	.02¾- .03	.02¾- .03½	.03½- .04
Ammonia, anhydrous, cyl.	lb.	.11 - .13	.11 - .15	.13 - .15
Ammonium carbonate, powd. tech., casks	lb.	.10½- .14	.10½- .14	.11 - .14
Sulphate, wks.	cwt.	2.45 -......	2.45 -......	2.55 -......
Amylacetate tech., drums	gal.	2.15 - 2.20	2.15 - 2.20	1.80 - 1.90
Antimony Oxide, bbl.	lb.	.16 - .16½	.16½- .17	.14½- .15
Arsenic, white, powd., bbl.	lb.	.03¾- .04½	.03¾- .04½	.03¾- .04½
Red, powd., kegs	lb.	.10¾- .11	.10¾- .11	.12 - .12½
Barium carbonate, bbl.	ton	50.00 -52.00	50.00 -52.00	48.00 -50.00
Chloride, bbl.	ton	58.00 -60.00	60.00 -62.00	63.00 -65.00
Nitrate, cask	lb.	.08 - .08½	.07½- .08½	.07½- .08
Blanc fixe, dry, bbl	lb.	.04 - .04½	.04 - .04½	.03½- .04
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.04½- .04¾	.04¾- .05	.05 - .05½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	3.50 -......	3.50 -......	3.25 - 3.50
Arsenate, dr	lb.	.07½- .08	.06½- .07	.06 - .07
Carbide drums	lb.	.05 - .06	.05½- .06	.05½- .06
Chloride, fused, dr., wks.	ton	21.00 -......	21.00 -......	21.00 -......
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05½- .06	.05½- .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.00 - 2.10	2.00 - 2.10	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	14.00 -17.00	15.00- 16.00	15.00 -18.00
Copper carbonate, bbl	lb.	.17 - .17½	.17 - .18	.16½- .17
Cyanide, tech., bbl	lb.	49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	4.95 - 5.00	4.80 - 4.90	4.75 - 5.00
Cream of tartar, bbl.	lb.	.22 - .22½	.22 - .22½	.21 - .22
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.74 - .76	.74 - .76	.80 - .82
99%, dr.	gal.	.95 - .96	.95 - .96	1.01 - 1.06
Formaldehyde, 40%, bbl	lb.	.11½- .11¾	.11½- .11¾	.09 - .09½
Furfural, dr.	lb.	.15 - 17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1 30 - 1.40	1.35 - 1.40	1.40 - 1.50
Refined, dr	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.00 - 1.15	1.00 - 1.10	1.20 - 1.40
Glycerine, c.p., drums, extra.	lb.	.25 - .26	.26 - .26½	.27½-......
Lead:				
White, basic carbonate, dry, casks	lb.	.09½-......	.09½-......	.10½-......
White, basic sulphate, sck.	lb.	.09½-......	.09½-......	.09½-......
Red, dry, sck	lb.	.10 -......	.10½-......	.12 -......
Lead acetate, white crys., bbl.	lb.	.13 - .13½	.14½- .15	.14½-......
Lead arsenate, powd., bbl	lb.	.12 - .13	.14 - .15	.14 - .15
Lime, chem., bulk	ton	8.50 -......	8.50 -......	8.50 -......
Litharge, pwd., csk	lb.	.09 -......	.10 -......	.11½-......
Lithopone, bags	lb.	05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags.	lb.	.07½- .08	.07½- .08	.06 - .06½
Methanol, 95%, dr	gal.	.66 -......	.83 - .85	.55 - .58
97%, dr.	gal.	.68 - .70	.85 - .90	.57 - .62
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk.	lb.	.12½-......	.12½-......	.14 -......
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.65 - .68
Yellow, cases	lb.	.32 - .33	.32 - .34	.33 - .34
Potassium bichromate, casks.	lb.	.08½- .08¾	.08½- .08¾	.08½- .08¾
Carbonate, 80-85%, calc., csk.	lb	.05¾- .06	.06 -......	.06 - .06½
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.08½- .09
Cyanide, cs.	lb.	.55 - .57	.55 - .58	55 - .57
First sorts, csk.	lb.	$0.09 -$0.09½	$0.08¾-$0.09	$0.08¾-$0.09
Hydroxide (c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07½- .07¾
Muriate, 80% bgs.	ton	36.40 -......	36.40 -......	34.90 -......
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums	lb.	.14 - .15	.14 - .15	.14½- .15
Prussiate, yellow, casks	lb.	.18½- .19	.18½- .19	.18½- .19
Sal ammoniac, white, casks.	lb.	.05½- .06	.05½- .06¾	.05½- .06
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.06¾- .06½
Salt cake, bulk	ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32½-......	1.32½-......	1.38 -......
Dense, bags	cwt.	1.37½-......	1.37½- 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	3.00 -......	3.00 -......	3.10 -......
Acetate, works, bbl.	lb.	.04½- .05½	.04½- .05	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Bisulphate, bulk	ton	5.00 - 5.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl	lb.	.03½- .04	.03½- .04	.03½- .04
Chlorate, kegs	lb.	.06¼- .06½	.06¼- .06½	.06¼- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl.	lb.	.08½- .09	.09½- .10	.08½- .09
Hyposulphite, bbl	lb.	2.50 - 3.00	2.50 - 3.00	2 65 - 3.00
Nitrate, bags	cwt.	2.65 -......	2 65 -......	2 57½-......
Nitrite, casks	lb.	.08 - .08½	.08 - .08½	.08½- .09
Phosphate, dibasic, bbl.	lb.	.03½- .03¾	.03½- .03¾	.03½- .03¾
Prussiate, yel. drums	lb.	.12 - .12½	.12 - .12½	.10½- .10¾
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.03½- .04	.03 - .03½	.02½- .03
Sulphite, crys., bbl	lb.	.03 - .03½	.03 - .03½	.02½- .03
Strontium nitrate, bbl.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphur, crude at mine, bulk.	ton	19.00 -......	19.00 -......	19.00 -20 00
Chloride, dr	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.19½-......	.19¾-......	.17 -......
Oxide, bbl.	lb.	.69 -......	.70 -......	.64 -......
Crystals, bbl.	lb.	.47 -......	.47 -......	.41½-......
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.06½- .06½	.07 - .07½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10½- .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.10½- .11	.10½- .11	.09 - .10
Zinc oxide, lead free, bag.	lb.	.06½-......	.06½-......	.07½-......
5% lead sulphate, bags	lb.	.06½-......	.06½-......	.07½-......
Sulphate, bbl	cwt.	2.75 - 3 00	2.75 - 3.00	2 75 - 3.00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.13 -$0.14	$0.13½-$0.14½	$0.12½-$0.13
Chinawood oil, bbl.	lb.	.20 -......	.25 -......	.12½- .13
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-......	.08½-......	.10½-......
Corn oil crude, tanks, (f.o.b. mill)	lb.	.08½-......	.07½-......	.13 -......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08 -......	.07½-......	.14 -......
Linseed oil, raw, car lots, bbl.	lb.	11.2 -......	11.2 -......	11.03 -......
Palm, Lagos, casks	lb.	.08½- .09	.07¾- .08	.09 -......
Niger, casks	lb.	.07¼-......	.07¾- .07½	.08½-......
Palm Kernel, bbl.	lb.	.08⅞-......	.09½-......	.10½-......
Peanut oil, crude, tanks (mill)	lb.	.12 -......	.12½-......	.12½-......
Perilla, bbl	lb.	....-......	....-......	....-......
Rapeseed oil, refined, bbl.	gal.	.80 - .82	.80 - .82	.89 - .91
Sesame, bbl.	lb.	....-......	....-......	....-......
Soya bean tank (f.o.b. Coast)	lb.	.09½-......	.10 -......	.10½-......
Sulphur (olive foots), bbl.	lb.	.09½-......	.09½-......	.08½-......
Cod, Newfoundland, bbl	gal.	.63 - .66	.63 - .64	.60 - .65
Menhaden, light pressed, bbl	gal.	.60 - .62	.60 - .62	.65 - .68
Crude, tanks (f.o.b. factory)	gal.	....-......	....-......	.47½-......
Whale, crude, tanks	lb.	....-......	....-......	....-......
Grease, yellow, loose	lb.	.06½-......	.06½-......	.08½-......
Oleo stearine	lb.	.09½-......	.09½-......	.14 -......
Red oil, distilled, d.p. bbl.	lb.	.09½- .10	.09½- .10	.10 - .10½
Tallow, extra, loose	lb.	.07½-......	.07½-......	.09 -......

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl	lb.	.85 - .90	.85 - .90	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.15 - .16	.15 - .16	.16 - .16½
Aniline salts, bbl	lb.	.24 - .25	.24 - .25	.22 - .23
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - 65
Benzaldehyde, U.S.P., dr.	lb	1.15 - 1.25	1.15 - 1.35	1.30 - 1.35
Benzidine base, bbl.	lb.	.70 - .72	.70 - .75	.72 - .74
Benzoic acid, U.S.P., kgs.	lb.	.58 - .60	.58 - .60	.56 - .60
Benzyl chloride, tech, dr	lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works	gal.	.24 - .25	.24 - .25	.25 - .26
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.	lb.	.18 - .20	.18 - .20	.18 - .20
Cresylic acid, 97%, dr., wks	gal.	.61 - .62	.61 - .62	.60 - .65
Diethylaniline, dr	lb.	.58 - .60	.58 - .60	.58 - .60
Dinitrophenol, bbl.	lb.	.31 - .35	.31 - .33	.31 - .35
Dinitrotoluen, bbl	lb.	.17 - .18	.17 - .18	.18 - .20
Dip oil, 25% dr	gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl.	lb.	.45 - .47	.45 - .47	.48 - .50
H-acid, bbl.	lb.	.63 - .65	.63 - .65	65 - .66

Coal-Tar Products—Continued

	Current Price	Last Month	Last Year
Naphthalene, flake, bbl.....lb.	.04¾- .05	.05¾- .06	.06¼- .07
Nitrobenzene, dr..........lb.	.09 - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl........lb.	.52 - .53	.45 - .50	.50 - .53
Para-nitrotoluine, bbl.......lb.	.28 - .32	.28 - .32	.40 - .42
Phenol, U.S.P., drums......lb.	.17 - .19	.17 - .19	.22 - .24
Picric acid, bbl.............lb.	.30 - .40	.30 - .40	.25 - .26
Pyridine, dr...............lb.	3.00 -......	3.00 -......	3.90 - 4.00
R-salt, bbl................lb.	.47 - .50	.40 - .44	.50 - .55
Resorcinal, tech, kegs.......lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl.....lb.	.30 - .32	.30 - .32	.32 - .33
Solvent naphtha, w.w.,tanks.gal.	.35 -......	.35 -......	.35 -......
Tolidine, bbl...............lb.	.95 - .95	.95 - .96	.90 - .95
Toluene, tanks, works.......gal.	.35 -......	.35 -......	.35 -......
Xylene, com., tanks.. gal.	36 - .41	.36 - .41	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl.....ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl...........lb.	.15 - .16	.15 - .16	.13½- .14
China clay, dom.,f.o.b. mine ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:			
Carbon gas, black (wks.)..lb.	.08 - .08½	.08 - .08½	.08 - .08½
Prussian blue, bbl.........lb.	.33 - .34	.33 - .34	.32 - .33
Ultramine blue, bbl.......lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl........lb.	.27 - .31	.28 - .30	.28 - .30
Carmine red, tins..........lb.	5.00 - 5.10	5.00 - 5.10	5.10 - 5.35
Para toner................lb.	.80 - .90	.80 - .90	.90 - .95
Vermilion, English, bbl....lb.	1.50 - 1.55	1.50 - 1.55	1.45 - 1.50
Chrome yellow, C. P., bbl.lb.	.17 - .18	.17½- .18	.17½- .18
Feldspar, No. 1 (f.o.b. N. C.) ton	5.75 - 7.00	6.50 - 7.00	6.00 - 6.50
Graphite, Ceylon, lump, bbl. lb.	.07½- .08	.07 - .09½	.09 - .10
Gum copal, Congo, bags.....lb.	.09¾- .10	.09¾- .10	.09¾- .10
Manila, bags..............lb.	.15 - .18	.15 - .16	.14 - .16
Damar, Batavia, cases.....lb.	.25 - .25½	.25 - .26	.25 - .25½
Kauri, No. 1 cases.........lb.	.55 - .57	.55 - .57	.58 - .62
Kieselguhr (f.o.b. N. Y.).....ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc..............ton	44.00 -......	44.00 -......	38.00 -42.00
Pumice stone, lump, bbl.....lb.	.05 - .07	.05 - .08	.04½- .06
Imported, casks............lb.	03 - .40	.03 - .40	.03 - .35
Rosin, H..................bbl.	10.45 -......	11.00 -......	13.00 -......
Turpentine.................gal.	.60½-......	.68 -......	.85 -......
Shellac, orange, fine, bags...lb.	.52 - .53	.47 - .48	.40 - .41
Bleached, bonedry, bags...lb.	.59 - .61	.50 - .52	.43 - .44
T. N. bags.................lb.	.40 - .45	.42 - .44	.32 - .34
Soapstone (f.o.b. Vt.), bags..ton	10.00 -12.00	10.00 -12.00	9.00 -11.00
Talc, 200 mesh (f.o.b. Vt.)...ton	10.50 -......	11.00 -......	10.50 -......
200 mesh (f.o.b. Ga.).......ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
325 mesh (f.o.b. N. Y.)....ton	13.75 -......	14.75 -......	14.75 -....1
Wax, Bayberry, bbl..........lb.	.25 - .26	.25 - .26	.20 - .21
Beeswax, ref., light.........lb.	.45 - .46	.45 - .47	.46 - .47
Candelilla, bags............lb.	.33 - .34	.34 - .35	.36 - .37
Carnauba, No. 1, bags.....lb.	.65 - .70	.70 - .72	.48 - .50
Paraffine, crude 105-110 m.p............lb.	.05¾- .06	.06 - .06½	.05¾- .06

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%......ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferrochromium, 1-2%.......lb.	.23- .25	.23- .35	.23- .
Ferromanganese, 78-82%....ton	90.00-.....	88.00-90.00	88.00-90.00
Spiegeleisen, 19-21%........ton	36.00-37.00	36.00-37.00	33.00-34.00
Ferrosilicon, 10-12%.........ton	33.00-38.00	33.00-38.00	33.00-38.00
Ferrotungsten, 70-80%......lb.	.95- 1.00	1.00- 1.05	1.05- 1.10
Ferro-uranium, 35-50%.....lb.	4.50-.	4.50-.....	4.50-.....
Ferrovanadium, 30-40%.....lb.	3.15- 3.75	3.25- 4.00	3.25- 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic.........lb.	$0.12¾-......	$0.13 -......	$0.13¾-......
Aluminum, 96-99%.........lb.	.26 - .28	.26 - .27	.27 - .28
Antimony, Chin. and Jap....lb.	.12 - .12½	.14¾-......	.19½-......
Nickel, 99%...............lb.	.35 -......	.35 -......	.35 -......
Monel metal, blocks........lb.	.32 - .33	.32 - .33	.32 - .33
Tin, 5-ton lots, Straits......lb.	.67¾-......	.68 -......	.59¾-......
Lead, New York, spot.......lb.	6.40 -......	7.15 -......	7.80 -......
Zinc, New York, spot.......lb.	6.57 -......	6.72½-......	7.45 -......
Silver, commercial..........oz.	.57½-......	.56½-......	.65¾-......
Cadmium..................lb.	.60 -......	.60 -......	.60 -......
Bismuth, ton lots...........lb.	2.20 - 2.25	2.70 - 2.75	2.70 - 2.75
Cobalt....................lb.	2.50 -......	2.50 -	2.50 - 3.00
Magnesium, ingots, 99%....lb.	.75 - .80	.75 - .80	.75 - .80
Platinum, ref..............oz..	86.00-......	108.00-......	105.00-......
Palladium, ref..............oz.	59.00- 63.00	68.00- 69.00	78.00-......
Mercury, flask...........75 lb.	117.00-......	126.00-......	91.25-......
Tungsten powder...........lb.	1.05- 1.15	1.05-......	1.18-......

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks.......ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post........ton	22.00- 24.00	21.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens.....ton	3.75- 4.25	3.75- 4.25	3.75- 4.25
Fluorspar, gravel, f.o.b. Ill....ton	18.00-..	18.00-......	18.00-......
Ilmenite, 52% TiO_2, Va.....lb.	.0¾- .0¾	.0¾ - .0¾	.01½-......
Manganese ore, 50% Mn., c.i.f. Atlantic Ports.......unit	.36 - .38	.36 - .38	.40 - .42
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y...........lb.	.48 - .50	.48 - .50	.65- .70
Monazite, 6% of ThO_2......ton	120.00-......	120.00-......	120.00-......
Pyrites, Span. fines, c.i.f.....unit	.13¾-......	.13½-......	.13½-......
Rutile, 94-96% TiO_2........lb.	.11 - .13	.11 - .13	.12 - .15
Tungsten, scheelite, 60% WO_3 and over.......unit	11.25 -11.50	11.25 -11.50	12.50 -13.00
Vanadium ore, per lb. V_2O_5..lb.	.25 - .28	.25 - .30	.30 - .35
Zircon, 99%...............lb.	.03 -......	.03 -......	.03 -......

Current Industrial Developments

New Construction and Machinery Requirements

Agar Plant—Agar Mfg. Co., 15 Winchester St., Medford, Mass., will build a 1 story, 150 x 300 ft. agar plant on Clyde St., Somerville, Mass. Estimated cost $150,000. H. M. Ramsay, 184 Boylston St., Boston, Mass., is architect. Work will be done by separate contracts.

Aluminum Casting Factory—Bohn Aluminum & Bronze Corp., 2512 East Grand Blvd., Detroit, Mich., is having plans prepared for the construction of a 1 story aluminum castings factory. C. W. Brandt, 1116 Francis Palms Bldg., Detroit, Mich., is architect. Equipment for handling castings will be required.

Asbestos Factory—Chicago Asbestos Co., 1428 Orleans St., Chicago, Ill., awarded contract for the construction of a 3 story, 25 x 80 ft. factory for the manufacture of asbestos pipe covering, etc. Estimated cost $10,000.

Asphalt Plant—Amesiete Asphalt Co., 880 The Arcade, Cleveland, O., plans the construction of a plant for the manufacture of amesiete asphalt at Nashville, Tenn.

Bottling Plant—Lindsey Industrial Alcohols Ltd., 19 River St., Toronto, Ont., awarded contract for the construction of a 3 story, bottling plant at Lindsay, Ont. to G. H. Lindsay, Lindsay, Ont. Estimated cost $80,000. Ten 8,500 gal. copper storage tanks will be required.

Brewery Equipment—Guckenheimer Distiller Co., Kitchener, Ont., wants prices and catalogs on complete equipment for recently acquired brewery. Estimated cost $250,000.

Bronze Powder Factory — The Ohio Bronze Powder Co., G. F. Glass, Pres., 1120 East 152nd St., Cleveland, O., awarded contract for the construction of a bronze powder factory to William Dunbar Co., 8201 Union Ave., Cleveland, O. Estimated cost $40,000.

Candy Factory—National Candy Co., 208 North Broadway, St. Louis, Mo., is having plans prepared for the construction of a 5 story candy factory at Grovois and Bingham Sts. Estimated cost $1,000,000. Klipstein & Rathmann, 316 North Eight St., St. Louis, Mo., are architects.

Cannery — Ray-Mailing Co., Hillsboro, Ore., is having plans prepared for the construction of a fruit cannery at Medford, Ore. Estimated cost $200,000.

Canning Plant Equipment—Jack Frost Packing Co., Inc., c/o Municipal Pier, Corpus Christi, Tex., plans to purchase machinery and equipment for canning plant. Estimated cost $25,000.

Cement Plant—The Northwestern Portland Cement Co., Dexter Horton Bldg., Seattle, Wash., awarded contract for the construction of a compressor house, substation, laboratory, office, etc. at production plant, Grotto, Wash. Estimated cost $600,000. Plant will have a capacity of 1,500 bbls. per day.

Cement Plant—The Pacific Coast Co., L. C. Smith Bldg., Seattle, Wash., plans the construction of first unit of cement plant, 500,000 bbls. annual capacity. Estimated cost $1,000,000.

Cereal Factory—Postum Cereal Co., Battle Creek, Mich., awarded contract for the construction of a 4 story factory for the manufacture of grape nuts to H. G. Christman Co., 315 Stephens Bldg. Estimated cost $300,000.

Cheese Plants—Lone Cheese Co., c/o F. Chandler, Pres., Stephenville, Tex., is having plans prepared for the construction of cheese plants, will establish one main plant at Brownwood, Tex. and nine smaller ones in surrounding counties for the manufacture, curing, etc. of cheese. Estimated cost $100,000. Complete equipment will be required.

Chemical Plant — Georgia-Louisiana Co., New Orleans, La. and Western Paper Makers Chemical Co., Kalamazoo, Mich., plan the construction of a plant for the manufacture of chemicals for the paper trade at New Orleans, La., also plant for the manufacture of sulphite alumna at Atlanta, Ga. R. S. Perry, 31 Union Sq. W., New York, N. Y., is engineer.

Chemical Plant — The Harshaw-Fuller-Goodwin Co., 100 Newburgh Ave., Cleveland, O., awarded contract for the construction of a 2 story, 38 x 40 ft. chemical plant to Hecker-Moon Co., 870 Union Ave., Cleveland, O. Estimated cost $40,000.

Chemical Plant Addition—The Grasselli Chemical Co., Guardian Bldg., Cleveland, O., awarded contract for the construction of a 1 story, 55 x 95 ft. packing plant and 1 story, 125 x 130 ft. warehouse at Lockland plant, Cincinnati, O. to H. K. Ferguson Co., 4900 Euclid Ave., Cleveland, O. Estimated cost $65,000.

Chemical Plant Addition—E. L. Patch Co., 38 Mt. Vale Rd., Stoneham, Mass., is receiving bids for the construction of a 5 story, 60 x 85 ft. addition to chemical plant including warehouse, etc. Densmore, Le Clear & Robbins, Park Sq. Bldg., Boston, are architects.

Chemistry Laboratory — University of Wisconsin, Madison, Wis., awarded contract for the construction of a 4 story, 40 x 200 ft. chemistry laboratory to De Forest Lumber Co., De Forest, Wis. and Maas Bros., Watertown, Wis. Estimated cost $278,873.

Clay Working Plant—American Brick Co., c/o H. M. Crawford, 810 Adeline St., Hattiesburg, Miss., has acquired the plant of the Riverside Brick & Mfg. Co., and plans extensions and improvements to increase the capacity. Private plans.

Cleaning Fluid & Paste Plant—The Cleveland Cleaner & Paste Co., F. U. S. Gilbert, Pres., 500 Central Viaduct, Cleveland, O., is having plans prepared for the construction of a 1 story addition to cleaning fluid and paste plant. Estimated cost $40,000. Private plans.

Coke Plant—North Shore Coke & Chemical Co., Waukegan, Ill., awarded contract for the construction of first unit of plant, to Koppers Construction Co., Union Trades Bldg., Pittsburgh, Pa. Estimated cost $1,000,000. Coke ovens, coal storage facilities, etc. will be required.

Color Type Plant—Multi Color Type Co., Eastern Ave., Cincinnati, O., awarded contract for the construction of a 2 story plant for the manufacture of multi color type to De Vore Construction Co., Dixie Terminal, Cincinnati, O. Estimated cost $40,000.

Compress Plant Addition—Port Compress Co., C. Pease, City National Bank Bldg., Corpus Christi, Tex., is receiving bids for the construction of an addition to compress plant. Estimated cost $250,000. Two additional units will be built later.

Compressor Station—Phillips Gas & Oil Co., Butler, Pa., awarded contract for the construction of a compressor station at Sprangle Mills, Pa., to The Austin Co., Union Trust Bldg., Pittsburgh, Pa. Estimated cost $40,000.

Cotton Compress Plant—California Compress & Warehouse Co., c/o M. Selig, 435 Cotton Exchange Bldg., Los Angeles, Calif., will soon award contract for the construction of a cotton compress plant at Wilmington, Calif. Estimated cost to exceed $250,000. Amwey, Bacon & Davis, 251 Kearny St., San Francisco, Calif., are architects.

Cotton Oil Mill—Citizens Cotton Oil Mill Co., Taylor, Tex., will build a cotton oil mill by day labor. Estimated cost $45,000. Machinery and equipment will be purchased later.

Cotton Oil Mill—Lockney Cotton Oil Co., Lockney, Tex., awarded contract for the construction of a cotton oil mill to J. S. Harrison Construction Co., 414 Liberty National Bank Bldg., Waco, Tex. Estimated cost $60,000.

Duntile Plant—The Chicago Duntile Products Co., 6522 South Nashville Ave., Chicago, Ill., plans extensions and improvements to plant for the manufacture of concrete building blocks at Kansas City, Mo. Estimated cost $60,000. Machinery and equipment will be required.

Dye Cleaning Plant—Monkey Dye Co., 3218 Troost Ave., Kansas City, Mo., awarded contract for the construction of a 2 story dye cleaning plant at 36th St. and Troost Ave. to Harvey Shrieves, c/o Sheppard & Pickett, 1208 R. A. Long Bldg., Kansas City, Mo., are architects. Estimated cost $65,000.

Enamel Products Plant—Superior Enamel Products Co., 1542 North Tenth St., St. Louis, Mo., awarded contract for the construction of a 1 story, 180 x 360 and 30 x 80 ft. plant for the manufacture of vitreous enamel parts for stoves and ranges, etc. at 6200 St. Louis Ave. to William H. and Nelson Cunliff Co., 410 North Euclid St., St. Louis, Mo. Estimated cost $250,000. Electrical heated enameling furnaces and complete system of conveyors will be installed.

Fig Preserving Plant—Texas City Canneries, C. I. Blume, Pres., San Leon, Tex., has acquired a site and plans the construction of a fig preserving plant at Texas City, Tex. Estimated cost $30,000. Canning equipment including 20 cooking kettles, etc. for 1,000,000 lb. pack will be required.

Gas House—Illinois Power & Light Corp., Decatur, Ill., plans to rebuild gas apparatus house recently destroyed by storm, also new gas house for 3rd new water machine. Total Estimated cost $135,000. Private plans.

Gas Plant—Mississippi Gas & Coke Co., Laurel, Miss., recently organized, awarded contract for the construction of a gas plant to Albert Garrett Construction Co., Canal Commercial Bldg., New Orleans, La. Estimated cost $500,000.

Gas Plant—Texmore Oil & Gas Corp., Pampa, Tex., is having plans prepared for the construction of a gas plant. Estimated cost $100,000. Private plans. New machinery will be required.

Gas Plant Addition—Arlington Gas Light Co., 689 Massachusetts Ave., Arlington, Mass., will soon award contract for the construction of addition to gas plant and holder at Gross St. and Highland Ave., Winchester, Mass. Gas & Electric Improvement Co., 77 Franklin St., Boston, Mass., is architect.

Gasoline Plant—Humphreys Corp., A. E. Humphreys, Kanwaka National Bldg., Charleston, W. Va., has acquired a tract of land in Humble Field, Tex. and plans the construction of a casinghead gasoline plant and pipe line. Estimated cost $250,000. Private plans. Machinery will be required.

Glass Plant—Gill Glass Co., Amber and Venango Sts., Philadelphia, Pa., will soon award contract for the construction of a 2 story, 150 x 250 ft. glass plant. Estimated cost $200,000. I. T. Catharine, Franklin Trust Bldg., Philadelphia, Pa. is architect.

Glass Plant—Illinois-Pacific Glass Works, Folsom and 15th St., San Francisco, Calif., had plans prepared for the construction of a glass plant, annual capacity 300,000 gross bottles, on Miles Ave., Los Angeles, Calif. Private plans.

Gum Plant Equipment—Goudry Gum Co. of Canada, 356 St. Antoine St., Montreal, Que., is in the market for complete equipment for proposed gum plant. Estimated cost $150,000.

Incandescent Lamp Factory—Nilco Lamp Co., St. Marys, Pa. is having plans prepared for the construction of a 2 story, 50 x 85 ft. incandescent lamp factory. Estimated cost $50,000. C. A. Searing, Farmers Bank Bldg., Pittsburgh, Pa., is engineer.

Jello Factory—Jell-X-Cell Co., c/o Foltz & Co., 510 North Dearborn St., Chicago, Ill., Contrs., awarded contract for the construction of a 2 story, 80 x 80 ft. jello factory at 74th St. and Woodlawn Ave. Estimated cost $50,000.

Kiln Building—Missouri Portland Cement Co., Post Dispatch Bldg., St. Louis, Mo., will soon award contract for the construction of a 40 x 400 ft. kiln building for cement plant on Prospect Hill. Estimated cost $2,000,000. F. L. Smidth & Co., 50 Church St., New York, N. Y., are engineers.

Laboratory — Yale University, New Haven, Conn. awarded contract for the construction of a 4 story, 150 x 200 ft. laboratory at Congress and Cedar Sts. to Hegeman-Harris Inc., 360 Madison Ave., New York, N. Y. Estimated cost $800,000.

Laboratory, Etc.—Dept. of Health, Capitol, Albany, N. Y., will receive bids about July for the construction of a laboratory, etc.

Laboratory Equipment—Dept. of Public Works, Ottawa, Ont., is in the market for complete equipment for proposed laboratory at Levis, Que.

Laboratories—Santa Rosa Infirmary, San Antonio, Tex., will soon award contract for the construction of a 5 story hospital including laboratories, etc. at Houston and Santa Rosa Sts. Estimated cost $300,000. A. B. & R. M. Ayres, 626 Bedell Bldg., San Antonio, Tex., are architects.

Lime Plant—Kunze Lime Co., South San Francisco, Calif., had plans prepared for the construction of first unit of lime plant including three kilns with capacity of 12 ton daily. Estimated cost $40,000. Private plans.

Magnesia Factory—New England Magnesia Co., M. A. Robinson, 84 Leverett St., Boston, Mass., awarded contract for the construction of a 2 story, 45 x 200 ft. magnesia factory on Heath St. to H. E. Cline Co., 43 Tremont St., Boston, Mass. Estimated cost $40,000.

Magnesia Factory — Philadelphia Magnesia Co., 1425 South 8th St., Philadelphia, Pa., will soon award contract for the construction of a 1 and 2 story, 56 x 91 ft. magnesia factory at 33rd and Dickenson Sts. R. E. White, Pennsylvania Bldg., Philadelphia, Pa., is architect.

Mechanic & Hydraulic Laboratories—Case School of Applied Science, C. S. Howe, Pres., Euclid Ave., Cleveland, O., will soon award contract for the construction of 3 story, 60 x 160 ft. mechanic and hydraulic laboratories at Euclid Ave. and Adelbert Rd. Estimated cost $150,000. Wilbur Watson & Associates, 4614 Prospect Ave., Cleveland, O., are architects and engineers.

Mining Plant Equipment—Burnet Copper Mining Co., A. Howell, Pres., Burnet, Tex., plans to purchase machinery and equipment including shaft, lifters, excavators, shaft elevator, etc. for mining plant. Estimated cost $75,000.

Nitrogen Products Plant — American Nitrogen Products Co., La Grande, Tex., plans the construction of a plant for the manufacture of nitrates used as basic for dyestuffs recently destroyed by fire. Estimated cost $300,000.

Paper Mill—Anglo Canadian Pulp & Paper Co., Quebec City, Que., awarded contract for the construction of a 2 story 228 x 232 ft. paper mill to W. Bishop & Co., Montreal, Que. Estimated cost $2,000,000.

Pasteurizing Plant—Borden's Farm Products Co., 110 Hudson St., New York, N. Y., is having plans prepared for the construction of addition pasteurizing plant at Long Island City, N. Y. Estimated cost $350,000. A. Allrich, 373 Fulton St., Brooklyn, N. Y., is architect.

Plastic and Stucco Plant—Carraway Engineering Co., 116 Broadway Ave., San Antonio, Tex., has acquired the Textucco Products Co.'s plant and plans extensions and improvements to increase the capacity at San Antonio, Tex., also improvements to same type of plant at Corpus Christi, Tex. Private plans. Machinery and equipment will be required.

Powder Plant—The Washington Safety Powder Co. of Seattle, G. H. Boucher, Pres., Seattle, Wash., plans the construction of a powder plant, 10 ton daily capacity at Ferndale, Wash. Estimated cost $100,000.

Pulp and Paper Mill—J. H. Bloedel of Bloedel-Donovan Mills, Bellingham, Wash., plans the construction of a pulp and paper mill, 110 ton daily capacity. Ultimate cost $5,000,000.

Pulp and Paper Mill—Nipigon Corp. Ltd., Nipigon, Ont., will soon receive bids for the construction of a pulp and paper mill at Port Arthur, Ont., capacity 200 ton, ultimate total capacity 400 ton daily. Estimated cost approximately $7,000,000.

Rayon Factory—The Industrial Fibre Co., H. Rivitz, V. Pres., West 98th St. and Walford Ave., Cleveland, O., will soon award contract for the construction of 1 story, 41 x 227 ft. rayon factory. Estimated cost $200,000. W. S. Ferguson Co., 1900 Euclid Bldg., Cleveland, O., is architect and engineer.

Refinery (Gold and Silver)—Handy & Harmon, 620 Kings Highway, Fairfield, Conn., awarded contract for the construction of a gold and silver refinery to Pardy Construction Co., 1481 Seaview Ave., Bridgeport, Conn. Estimated cost $45,000.

Refinery (Sugar)—National Sugar Refining Co., Front St., Long Island City, N. Y., had plans prepared for the construction of a sugar refinery and power plant. Estimated cost $1,000,000. Private plans.

Roofing Plant—Ora-Lastic Products Co., Fairfax Industrial Dist., Kansas City, Kan., plans to remodel plant for the manufacture of roofing materials, etc.

Rubber Factory—B. F. Goodrich Rubber Co., Akron, O., is having plans prepared for the construction of a 4 or 5 story, 250 x 1,200 ft. rubber factory at Los Angeles, Calif. Estimated cost $4,000,000. S. B. Robertson, c/o owner, is engineer.

Soap Factory—Proctor & Gamble Mfg. Co., Gwynne Bldg., Cincinnati, O., awarded contract for the construction of a 2 story, 50 x 172 ft. soap factory at Kansas City, Mo. to Morley Bros. Construction Co. 722 Dwight Bldg., Kansas City, Mo. Estimated cost $60,000.

Smelter Mill—Shawinigan Water & Power Co., Gros, Pin, Que., will soon receive bids for the construction of a smelter mill.

Smelter Plant—H. Carmichall & Associates, Victoria, B. C., will soon award contracts for reconditioning smelter plant and new ore shipment wharf, etc. Estimated cost $40,000. W. G. Swan, Birks Bldg., Vancouver, B. C., is engineer.

Smelting Plant and Foundry—The Rivers Smelting & Refining Co., J. W. Grodin, Pres. and Treas., Bradley Rd., Cleveland, O., had plans prepared for the construction of a 2 story, 86 x 126 ft. smelting plant and foundry. Estimated cost $100,000.

Steel Foundry—Gould Castings Corp., A. R. Gould, 5256 Vernon Ave., St. Louis, Mo., will receive bids about June 9 for the construction 1 story, 150 x 375 ft. steel foundry for the manufacture of steel, gray iron, brass, bronze and other castings at Gould and Quindaro Rds., Kansas City, Mo. Private plans. Complete equipment including electric furnace, etc. will be required.

Sulphuric Acid Plant—Consolidated Mining & Smelter Co., Ltd., Trail, B. C., will soon receive bids for the construction of a sulphric acid plant. Estimated cost $250,000. Complete equipment will be required.

Varnish Factory—Murphy Varnish Co., 50 West 22nd St., Chicago, Ill., has work under way on the construction of a 1 story varnish factory at 6540-6544 South Laramie Ave. Estimated cost $100,000.